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AVIATION WEEK

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AVIATION CALENDAR

- Nov. 20-Second World Microfluidic Conference & Exhibition**, National Micro Exposition & Congress, Palais des Congrès, Hotel Sheraton and International Amphitheatre, Chicago.

Nov. 21-Fourth Institute on Microsensors at Management (international data processing system), The American University, 1900 F St., Washington D.C. 20006.

Nov. 21-22-Yield Validation Methods and Model Reliability Response Seminar, Jointly by the Yield System Research Department, Nippondenso Mando Test Center, P.O. Nagoya 466.

Nov. 24-25-Third Annual Auto-Comp Seminar, The Institute of Auto Engineers, Fraunhofer Institute for Mechatronics and Production Systems, Heilbronn 10, W. Germany.

Nov. 24-25-National Meeting, Weapons Systems Management, Institute of the Aviation Sciences, United States Air Force Academy, Colo.

Nov. 24-25-Annual meeting for Aerospace Electronics Research Division, Commercial Society of Photon Engineers, Hotel Ambassador, Los Angeles.

Nov. 24-25-Held in IEEE Instrumentation Conference and Exhibit (Joint Meeting), Hotel Pennsylvania, New York City.

Nov. 24-25-Annual Meeting, National Safety Council, Flight Safety Foundation, 500 One Cole Pkwy Aviation Work Safety Awards Dinner, Nov. 24. For Details see IEEE Pkwy Award, N.Y. T.C.

Nov. 24-25-Annual Convention, Maritime Transport Association, Convention, Tropicana Hotel, Atlantic City, N.J.

Nov. 25-26-Biannual Auto-Comp Reliability Conference, Park Sheraton Hotel, Held, Inst. sponsored by Vickers Inc. (Invited Papers).

Nov. 25-26-11th Annual Electronic Components, Materials, Applications, Kansas City, Mo.

Nov. 25-26-The Society of Technical Writers and Editors' 1985 annual conference, Hotel New York, New York.

(Continued on page 106)

[Continued on page 6]

PREC

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СИМВОЛЫ УДК ■ ИНДИКАТОРЫ А. ТОСТ

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January 1965

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AVIATION CALENDAR

(Continued from page 5)

- Nov. 13-15—15th Annual Conference, National Aviation Under Arms, Hotel Adelphi, Atlanta
- Nov. 21-22—Eight National Plastic Exposition, International Amphitheatre, Chicago
- Nov. 15-16—Third Nuclear Electronic Manufacturing School, Instrumentation Division, Radio Electronics Inc., 710 S. Fulton Ave., Mt. Vernon, N.Y.
- Nov. 21-22—Military Design for Aerospace and Electronic Development, Contractors and Producers Prod., 17th meeting, Nov. 26-27—AGARD Aerothermal Panel, Norwegian Hotel, Washington, D.C.
- Nov. 18-19—Turbofan Conference, International Air Transport Assn., Paris, France
- Dec. 18-20—10th Meeting, Aviation Electronics Manufacturers Assn., Hotel St. Louis Copley Plaza, Detroit
- Nov. 25-30—Joint Strength Testing Committee, Hotel 365, El Paso, Texas, New York
- Dec. 26—Aerospace Rocket Society, annual meeting, Hotel Statler, New York
- Dec. 8-9—Symposium on High Temperature Stress, paper "Assessment Materials Life Assessment," Acoustical Materials Laboratory, Acoustical Control, Philadelphia, Pa.
- Dec. 9-13—1957 Entom Joint Computer Conference and Exhibit, Statler Hotel, Washington, D.C.
- Dec. 16-18—Traffic Control Symposium—"The Means and Methods of the Airway Modernization Board," sponsored by the American Federation of Engineers
- Dec. 20-21—Turbine Engine Development Seminar, Hotel Adels, S. E. Sprague, U.S.N. An Development & Material Centers at Englewood Cliffs, Philadelphia, Pa.
- Jan. 16-19—National Congress, Electronics Reliability and Quality Control, Hotel Statler, Washington, D.C.
- Jan. 20-21—First Annual Meeting, American Reliability Association, N.Y.C.
- Jan. 26-31—American Society for Engineering Education, 1958 College-Scholarship Conference, University of Michigan, Ann Arbor, Mich.
- Jan. 30-31—Second Annual International Space Congress sponsored by Southwest Defense Council Association and Los Angeles Hyatt Regency Hotel, Los Angeles City College, Los Angeles, Calif.
- Mar. 17-21—1958 Division Conference, American Society of Mechanical Engineers, Hotel Hilton Head, Dallas, Tex.
- Apr. 17-18—RFT-RNAC Aviation, (World War II), Toronto, Canada, Concourse C & Dining, Circassian, 149 South Drive, Toronto 1
- April 17-18—Institute of Environmental Engineers, Stevens Institute of Technology, New York City, New York, New York
- April 23-24—1958 Electronic Components Conference, seminar "Reliable Applications of Compound Pads"

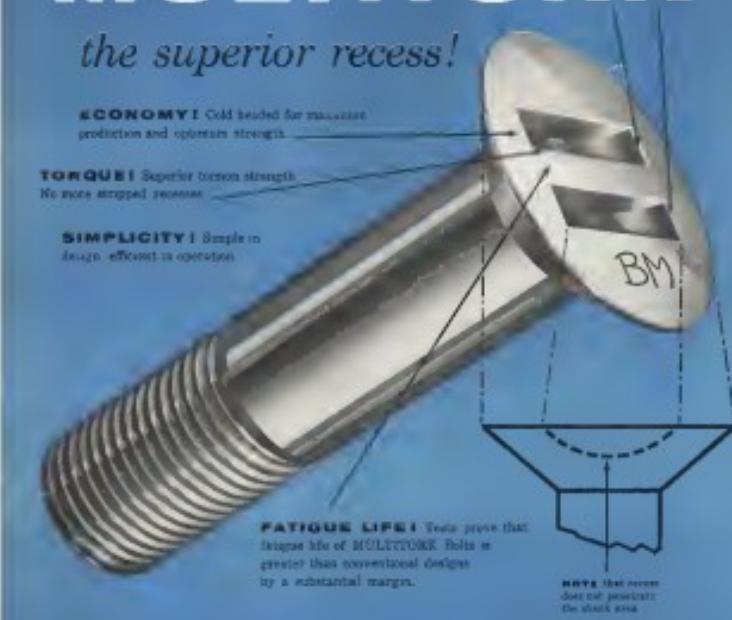
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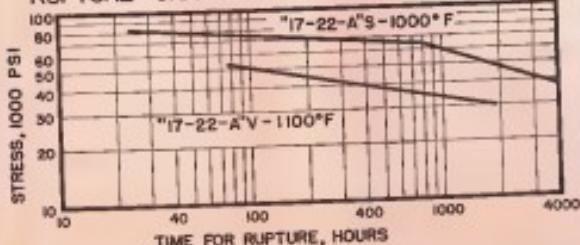
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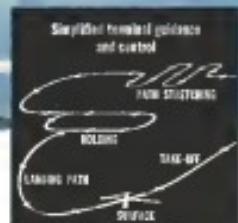


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November 4, 1957

Baltimore Office

AVIATION WEEK

Vol. 67, No. 18

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New B. F. Goodrich laboratory is proving ground for fuel cells



B.F.Goodrich

B.F. Goodrich Aviation Products' new Fuel Cell Development and Testing Laboratory at the big BFG Los Angeles plant is the hot word in fuel cell research. Here, engineers measure constant quality checks on cells being produced for many aircraft including the Lockheed 1049, T-33 and F-104, the Boeing B-52, the Douglas F4D and the Northrop T-38. In addition,

fuel cell designs and materials are being developed to meet the requirements of future aircraft still on the drawing boards.

A representative sample of the laboratory's facilities is shown here. Among the operational types of apparatus are a giant "hot and cold" room, where for stress, abrasion and vibration, fuel cells, using state-



FABRIC TEST B.F. Goodrich technicians in a test booth check cell foils that have undergone a heat cycle and pressure test in BFG's oven.



"HOT/COLD" TEST. Test platform under 30,000-lb load through 20° angle to determine capacity of tested fuel cell as reflected by weight loss.



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EDITORIAL

Who Are the Real Culprits?

Readers will recall the story we published on Oct. 21, page 25, telling how the U.S. has been tapping Romanoski missile nests for more than two years with scientific equipment including a giant radar located in Turkey. In an accompanying editorial entitled "Why, Mr. Cutler?" we detailed the reasons for publishing the story at that particular time and raised the following question:

It is high time the American people asked their governmental why, in view of the overwhelming evidence available to it during the past two years on Soviet technical progress, it is still pursuing a policy that is slowing the pace of our military technology and tipping our future military strength?

Fulminations in Private

There has been plenty of reaction. On the one hand, the story and its accompanying editorial have stimulated daily newspaper stories and editorial reactions around the world. On page 29, we are reprinting editorial comment on this subject from leading American news papers. We have also received much reaction from aviation industry and military sources.

There has been another kind of reaction, too, coming primarily from President Eisenhower's personal associates such as his press secretary, James C. Hagerty, Jr., his foreign economic policy adviser, Clarence Randall, and Robert Cutler, his assistant for national defense matters.

All of these men have had a concern about them. For example, Mr. Hagerty elaborated at some length in daily newspaper reports questioning the basis on which he had declined to back his comments with the use of his name or official position. They appeared in the daily press anonymously, attributed to a "top Administration official." Mr. Randall Mowry made similar comments of "irresponsible and ridiculous" privately. Later that week, he made a public speech referring to the Soviet Spetsnaz unit as a "fifth column." This comment drew howls from such a distinguished Republican leader as Sen. Styles Bridges of New Hampshire.

What Did Cutler Say?

But even more curious is the performance of Robert Cutler on Saturday Oct. 26 at Hot Springs. He was invited to speak before the Commerce Department's Business Advisory Council, which is a group of 100 leading businessmen who meet periodically to advise the government on national policy purposes. Saturday night is always a festive occasion of the council. The work has been done, and coast-to-coast telecasts and their wives have played in golf and tennis tournaments. At the Saturday night affair after dinner, the words for these toasts are made. The job of the speaker at that affair is probably to get everyone in a happy mood and keep them there. The reception that follows the dinner is always an enjoyable affair.

Now we don't know what Mr. Cutler actually said that Saturday night in Hot Springs. In keeping with council tradition, there were no reporters present at the dinner. But after the dinner, several accounts of what Mr. Cutler said regarding our missile monitoring story blossomed from the dinner guests. The Cincinnati Times-Star Washington correspondent reported that "A White House official has made a shadow attempt at censorship of a legitimate national publication by suggesting an advertising boycott. Such is the carefully-worded word visiting the association from Hot Springs, Va., where the Business Advisory Council of the Commerce Department has just completed a meeting."

Then Robert Cutler, special assistant to President Eisenhower for national security affairs, virtually accused a respected American trade journal's editor of treason and strongly implied the responsibility of publishing the magazine by withholding advertising. His suggestion was made to members of the Council who represent the leadership of the nation's top business, industry and advertising budget. It was made off the record at a closed session, so that there was presumably no way of counteracting it.

The New York Journal of Commerce reported in a sidebar item on Mr. Cutler's appearance before the Council:

Cutler via Hagerty

By the middle of last week, Mr. Cutler also sober reflected had a different version of the affair. Speaking through White House Press Secretary Hagerty, he dodged direct conflict with reporters. Mr. Cutler denied he had mentioned "treason" but suggested an advertising boycott. He admitted claiming that the *AVIATION Week* story was "sheeshed" and that the story was a violation of the law, although he would not state what law. He was also reported to be interested that his Hot Springs speech had reached the newspapers "because no reporters were present."

It is difficult to tell truth from evasion in the conflicting reports of Mr. Cutler's Hot Springs speech. We don't like to sweep several bad reports because they are often inaccurate. But it is agreed by all parties concerned that Mr. Cutler and *Aviation Week's* publication of the missile monitoring story was "sheeshed."

We would like to ask Mr. Cutler and the American people which is the really shameful act:

- Withholding the true story of the rapid program as Russia carries on the American people while at the same time cutting back our own military research, weapons development and production programs to weaken our future military strength?

- Or telling the American people the truth about the vital facts that were withheld from them on the plain grounds of "security" and pinning the proper label on the governmental officials who deliberately withheld this information?

—Robert Hote



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WHO'S WHERE

In the Front Office

Edwin Hobbs, Jr., board chairman, Westinghouse Electric Corp., Pittsburgh, Pa.
William S. Lewis, Jr., a director, Board Engineering & Manufacturing, Inc., Great Neck, Calif.

Jack Staples, president and a director, well-established United Defense (U.S.A.) Inc., a division of United Aircraft of America, Ltd., Greenwich, England.

Matthew J. Reilly, president, Thales, Inc., Springfield, Mass.

Daniel Pennington, president, located American Aerospace (D.P.A.) Inc., New York, N.Y.

E. E. Harpe and H. G. Conner, deputies managing directors, Matra Brothers & Hoechst Ltd., Rehovot, Israel.

Robert A. Lohman, director vice president general manager and a director, American Precision Industries, New Haven, Conn.

Marvin F. Feltenglass, executive vice president, Land Air, Inc., San Francisco, Calif.

Albert S. Blanchard, executive vice president, Stanley Corporation of America, Inc., Stamford, Conn., and a director, Bausch & Lomb, Inc.

Louis R. Fagan, senior vice president, Clinton Precision Products Co., Inc., Clinton Heights Pk, Alba, Arnold E. Heron, Thornton M. Stoops, Alex R. Olson, and W. C. Edelmann, all of McDonnell, St. Louis.

Charles M. Abelson, vice president manufacturing, Hark Manufacturing Co., Detroit, Mich.

Honors and Elections

Cdr. John F. Steys, Chief of the Army Medical Field Laboratory at McGuire AFB, has been awarded the Giugia Medal, which is awarded for distinguished work in preventive medicine. In the Association of Military Surgeons Dr. Steys was selected as the elected member of the year for his contributions and in acknowledging that the laureate fully out stand some slack longer better than the structure of an explore."

Dr. Wolfgang B. Klemperer, chief of Douglas Aircraft's medical research department, has been elected a fellow of the Royal Society of Technical Sciences from the Institute of Technology in Vienna (Austria). For his "profound and internationally recognized research work in the field of aeromedics."

Changes

Jack J. Jones, weapons systems manager, Q-5/10 program (MC bomber), North American Aviation, Inc., Los Angeles, Calif., also appointed requirements engineer for the Q-10 program, and E. H. Scott, formerly of the Q-5/10 and H. E. Dale on a long range interceptor project.

Ferdinand V. Ladhera has joined the engineering and management staff of the California Division of Lockheed Aircraft Corp., Santa Clara, Calif., as a design engineer with responsibility of all Lockheed military aircraft.

Dr. George L. Feke, Test Right test director, Guided Missile Research Division, Ramo-Woolridge Corp., Los Angeles, Calif.

INDUSTRY OBSERVER

► Configuration of North American Aviation's in-service strategic missile planned for the Boeing B-52 has been supplemented by the XSM-64 Starbird intermediate version of the canceled intercontinental missile project bearing the temporary designation C-36. Finselage is circular in cross section, has canard surfaces and a short 40 ft. long. Wing is delta type, and control surfaces are used. Scheduled powered by the Pratt & Whitney J52.

► Theory that Atlas powered sailplane has thus far have resulted from cavitation is being thoroughly investigated at Garrett Corp.'s Allentown facility at Philadelphia where special facilities have been established to check the theory.

► McDonnell Aircraft is working on a three-to-four ton transport conversion proposal, utilizing much of the company's experience with the XV-1. There is a possibility that the design may be evolved as the Army Navy competition for a helicopter in the medium class. McDonnell also is building a smaller passenger helicopter of about eight passenger capacity. Prototypes will roll out early next year. Designated the D-200, the helicopter will have a single rotor 35 ft. in diameter.

► Watch for a Royal Air Force decision within the next six months on whether a supersonic bomber will be developed to succeed the Avro Vulcan and Handley Page Victor now ticketed as the backbone of the Bomber Command's oblique and hydrogen-bomb-equipped striking force. RAF thinking has been retarding time initial "off schedule" of second flight of the Avro Vulcan while papers on defense and a leading handily toward another generation of supersonic strategic interceptors and bombers.

► Proposed test vehicle for the intercontinental ballistic program contains a North American Navaho booster and an Aeromet Attacker in a second stage. Range of the combination would be about 3,600 miles, and vehicle could duplicate zero gravity conditions for about 30 minutes, approximately the time required for ICBM flight.

► Space requirement for F-100 stretched, plus long auto-loading tank, put side pods has been raised from 360 to 395 after unanticipated result with 1,600 pounds in service.

► Omega Avocet plans to begin limited production this week of its 1,000 lb. payload flying crane. Initial development was undertaken by the company, which spent approximately \$400,000 on the project, about half of it in Civil Aeromarine administrative cost-sharing tests. Omega expects FAA certification of the helicopter within the near future.

► Royal Air Force is concentrating on a major development effort in the English Electric P.11 supersonic fighter design to 43 tons load for interceptor aircraft for the future rather than any more new designs. P.18 version of the English Electric design is now operating in the 1,200 mph speed range.

► Watch for a direct tie-in between Marquandt Aircraft Co. and René Leduc, Paris, Marquandt, impressed with the technical quality of Leduc's work, visited the French firm recently and discussed means of keeping the Leduc work alive in the face of French controls (see p. 90). Two possible alternatives were considered—either financial aid to Marquandt or the Leduc aircraft aircraft or hiring of Leduc to a Marquandt competitor which would make his skills available in the U.S. Leduc's current field of interest includes nuclear reactors.

► Army has not relaxed its determination to cut helicopter operating costs despite wide progress in last two years. Transportation Corps Supply & Maintenance Command says improved service life of helicopter components and longer periods between overhauls do not result in enough economy in view of the current severe military budget.

► Great Central third-stage rocket for the Vanguard satellite vehicle shows a consistent specific impulse of about 140 seconds.

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Avco makes things better for America

Avco

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Washington Roundup

New Look at Soviets

Top scientific, industry and USAF technical brass met recently in Baltimore at a top secret meeting to take a fresh eye look at the relative military aerospace strength of the U.S. and the Soviet Union. Meeting was ordered by President Eisenhower and presided over by Dr. Edward Teller, known best for his contribution in developing the hydrogen bomb. Meeting's conclusion was that period of maximum danger from Soviets will begin around 1958, an estimate that the Soviet threat around 1960 would be seen at its greatest period. New improvements in Soviet air defense come against inferior bombers such as B-47 and B-57 was major factor in the new estimate. Preparations for U.S. action to regain weapons development capacities have been submitted to President Eisenhower through the Defense Department.

No 'Ball-Park' Estimates

Watch for increased USAF efforts to force automation into supplying more accurate antibiotic. Brig. Gen. W. Austin Davis, assistant for production programming in the office of the Deputy Chief of Staff, Materiel, puts it this way:

"Computer functions must be analyzed to get much more accurate figures regarding funds needed in a given month or quarter."

"There is no room," Gen. Davis says, "to wait to be invited to share a half picture of dollar amounts spent to date on a given project. We cannot accept ball-park estimates."

It is no secret that USAF has been irritated by some of the off base figures offered recently. There were some estimated billings that were running in millions of dollars, thus complicating the USAF claim of splitting a limited nation.

In another angle, Gen. Davis has suggested that "today we should take the same dual-emphasis view toward developing systems for the Air Force that it takes toward private projects."

"According to reasonable estimates," the General says, "we can probably speed up our 40% more for a given research-development program than they do when using their private capital. If pushed to it, I could give specific examples."

"Now I realize there would be a slight and reasonable additional cost due to certain procedures for confidentiality and security, but 30% should cover that, not 40%."

Missile Decision Hanging Fire

Possibility of a fast decision from the House now concerning awarding delivery contracts to the Army, Air Corps and USAF Thor missile range ballistic missile development committee to some Pentagon observers Committee is composed of Maj. Gen. Bernard A. Schriener, commander of USAF's Reliability Missile Division; Maj. Gen. John S. Medina, chief of the Army Ballistic Missile Agency; and William H. Halsted, Special Assistant Secretary of Defense for Guided Missiles.

In effect, Halsted is sitting as a judge in the Army-Air Force competition without any legal composition all-power to look over the shoulder. With a lack of sufficient orders on the subject, Halsted and staff will be forced to rely on the principles for their technical information.

Possible solutions for the impasse, Defense Secretary Neil H. McCallum may be forced to take over, and advice from scientists, industry experts and senators to find out which name is best.

New Industry Probe

A House Small Business Subcommittee headed by Rep. Tom Stodd (D., Okla.) is launching an investigation of the aircraft and guided missile industries to see if small firms are receiving a proper share of defense contracts.

ANDB Demise

An Strategic Development Board officially came to an end last week with a presidential order transferring the agency's personnel, records, property and funds amounting to \$2 million to the newly organized Aerospace Modernization Board. The President's action also approves the transfer of "extensive" research and development functions from the Defense and Commerce Departments to the new board but does not affect the Civil Atmospheres Administration programs for the testing, evaluation and modification of balloons and devices developed for use on the federal survey system under the CAA survey modernization plan.

'Awoken U. S.'

All scientists with whom President Eisenhower has talked so secret code words "agent" that this problem of isolating America in one in which they believe I have a part," the President said last week. Science Advisor, Executive Office of Defense, Michaelson, "is putting a plan in which they hope to lay out my part of it," the President said, and by mid-June the plan it he thinks it is terrible, "because I believe exactly what they say."

Committee's chief concern is not strategic position of scientific advancement of U.S. and any other nation but "whether we are going to be in 10 years," Eisenhower said. The President will not let scientists know about his part until "awakened." The United States is the importance and uphold the absolute necessity of increasing our scientific output of our colleges and universities, even if "cautious" federal support is necessary.

Third Pilot vs. Engineer

An Long-Range Army hopes of replacing flight engineers with a third pilot crew member on jet transports has been at least temporarily shattered at one aircar. The American World Airways and Flight Engineers International Association will sign an agreement which called flight engineers as a case against whenever man than normal load factors are required by company or Civil Aviation Administration regulations.

At its 1956 biennial convention, the Long-Range Army introduced a resolution that would require elimination of a flight crew to be qualified as pilots. However, the Pan American agreement, which was made June 1956, clearly spells out the airline's intention to retain flight engineers. The agreement says: "It is the specific intention of the parties that Pan American shall not assign a pilot-engineer, in the term is understood, in place of a passenger engineer to perform the engineering function." —Washington staff

House Probes Cutler Speech Attacking Missile Monitor Story

Washington—(Eisenhower) last week began a preliminary investigation of reports that Presidential Assistant Robert Cutler referred to a story published by Associated Press as "revisionist" and suggested to a group of leading members that administration should bring the story down.

The story, which appeared in the Oct. 21 issue, page 36, reported that Soviet missile funds have been tucked by the U.S. into Turkey for more than two years.

Chairman John E. Moss (D-Calif.) last week ordered the Information Subcommittee's staff to investigate Cutler's remarks. The staff has written to Cutler asking for a full explanation. The committee is to determine whether the subcommittee will hold hearings at the request of the House Select Committee.

Cutler made Oct. 16 at a dinner meeting in Hot Springs, Va., following a two-day meeting of the Commerce Department's Business Advisory Council. The dinner was attended by Congressmen and their wives.

Council meetings are closed to the press on the theory that businessmen will advise the government more freely in private. The dinner also was closed to the press.

Cutler is Special Advisor to the President for Economic Security Affairs, chairman of the National Security Council's Planning Board, a member of the Security Council's Operations Coordinating Board and a member of the Council on Foreign Economic Policy.

Associated Press could not reach Cutler last week for comment, although it was in touch with him after several times.

Key by Proxy

By late last week, his only public comment on the incident had arrived through Represen-tative Fred Shuman, Chairman James C. Hagerty's top-ranking Senate Government Relations, a member of the Security Council's Operations Coordinating Board and a member of the Council on Foreign Economic Policy.

Hagerty could not reach Cutler last week, for comment, although he was in touch with him after several times.

Army Awards

Washington—Army last week awarded its Legion of Merit to Maj. Gen. John B. Shadley and its Exceptional Civil Service Award to Dr. Webster von Braun for their contributions to Army's Japanese missile development program.

Awards came at the final annual meeting of the Association of the U.S. Army.

Gen. Shadley commands the Army Ballistic Missile Agency at Huntsville, Ala., and Dr. von Braun is Director of the Development Operations Division of Army's Redstone Arsenal there.

Army Secretary Willis M. Rucker, presiding over the event to Dr. von Braun, called Japan "this nation's first intermediate range ballistic missile" and "the most advanced guided missile yet produced in the free world."

and Cutler named himself as that by referring back to her notes.

Other reporters contradict Cutler's version of what he did, as relayed through Hagerty.

The Associated Press quoted members who attend the meeting as saying that Cutler had asked them to "cancel" the Associated Press, and the word "cancel" was "blurred" or that he had suggested that editors do the same right on account their advertising policies with regard to that publication.

But, the Journal said, referring to persons who attended the meeting, Cutler "labeled the story as 'revisionist' in response to a question." He did not name Associated Press but referred to it as "an undesirable entity" selling for 75 cents, and "an other wealth magazine" as "far more expensive," publishing such a story, the Journal said.

The Associated Press quoted one of the 60 editorial members who are additional members of "gradualists" in contrast, adding to about 100 of the nation's leading journalists, the Journal said. "Some of the largest publications in the U.S. are not the largest, we were assured."

The Journal's account of the Cutler-Hagerty dinner reported Hagerty as believing that "at no time did [Cutler] mention advertising one way or another."

Albert Lerner, chief price officer of the Commerce Department, also told those words. "If any of you [Soviet advertising] people are here, I suggest that you come to me and tell me what you give us for better insertion," he said.

The Journal of Commerce on Oct. 29 reported that "two versions of an anti-Soviet" at the Hot Springs meeting "have Washington bunting."

"According to persons who attended the meeting," the Journal said, "an advertising boycott of a magazine that had published a story the Administrator considered dangerous to national security was suggested by President Eisenhower's Special Assistant for National Strategic Affairs."

"Robert Cutler, the special assistant, denied having told a dinner meeting of the kind that he was quoted as having told by the Journal. Associated Press was 'blurred' or that he had suggested that editors do the same right on account their advertising policies with regard to that publication."

But, the Journal added, referring to persons who attended the meeting, Cutler "labeled the story as 'revisionist' in response to a question." He did not name Associated Press but referred to it as "an undesirable entity" selling for 75 cents, and "an other wealth magazine" as "far more expensive," publishing such a story, the Journal said.

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Lerner said his conclusion of what Cutler said and did not say is "folklore" and not what Cutler has [Hagerty] said.

Loyd Wright, who is Vice Chairman of the Senate Government Relations, told reporters here that he reported that "some would not think we were clever" at the possibility of naming the enemy before publishing that type of thing," the Associated Press quoted "Moss on 'em," Wright said. "I think a lot of the government's records classification is nonsense. On the other hand, no private citizen has the right to sweep the powers of duly constituted authorities."

Wright's conclusion, a group of 12 senators sponsored by the President, Vice President and Speaker of the House, recommended in a 1960s bill which includes fiscal and organizational reforms for the Senate and its committees.

Hagerty quoted Cutler as saying that "at no time in the speech" did he discuss names or advertising. Hagerty

U.S. Press Endorses Missile Radar Story

Following are edited comments from some of the nation's leading newspapers on Aviation Week's decision to publish a story on the U.S. radar base in Turkey (AW Oct. 21, p. 26).

Radar Message

Los Angeles Examiner
And the Hearst Syndicate

Declining that United States long-range radar, based in Turkey, has been tracking Soviet missile tests since the summer of 1953, meaning, implicitly, complicity by the Administration and the Pentagon.

Certain unnamed spokesmen for the Administration are angry at Associated Press, the magazine that broke the story, on the grounds of publishing classified information. It appears more likely the Administration sugar is the heavy end of a two-edged sword.

From whom was that information classified?

On the facts of possible detecting, it is almost impossible that the Russians did not know of our radar installations in Suezian as far as the Turkish Black Sea area. Any device that emits powerful electromagnetic radiation does not remain a secret very long.

The Turks knew about it, naturally, so did the Americans and the British. But it is the American public that was "classified" out of knowing.

The Adminis-tration and the Pentagon would have done better to focus less about keeping the radar tracking secret, and worry more about its meaning.

In 1957 the radar began tracking data on Soviet intercontinental missile flights, said at least one official source here at Krasnoyarsk, northeast of the Black Sea.

In 1958 the radar picked up a shift of flying patterns that indicated these missiles were in actual production.

Like in 1956 the radar picked up the first test flights of the sixth stage development of the intercontinental missile.

During this year, our satellite project continued to be separated from missile development, and missile development continued to be a matter of major and major areas of the public and private sectors.

So that radar system in Turkey has done something more than pick up Soviet missile advances. It reflects the ingenuity of the Administration and the Pentagon in fitting up to the facts.

Moshe Sputnik has changed all that. We hope so.

Matter of Fact

By Stewart Alsop

New York Herald Tribune
Washington Post and Times Herald
And Herald Tribune Syndicate

CERTAIN VERY large and ugly acts have been let out of the bag in recent days. These revelations cast a new light on the Eisenhower Administration's policies in the case with the Soviet Union for intercepting ballistic missiles. And in the new inevitable full-blown investigation of these policies, the acts that have been let out of the bag are going to be very hard indeed to explain away.

Can No. 1 now be seen in the administration's technical armament? Associated Press, which a radar tracking station in Turkey has been intercepting tests of ballistic missiles in the Soviet Union for more than two years. The report has not been denied for the simple reason that it is true—the existence of the radar station, which is of course known

to the Soviets, has been common knowledge among those who know their way around the military for long time.

The running of the particular radar is another question. The Administration has not lied to give cover to Soviet programs in the missile field, to try to catch satellite intelligence agents. As it knows, without the slightest room for doubt, that the Soviets have had hundreds of the shorter range missile missile, scores of the intra-missile missiles, and this year at least eight missiles of intercontinental range.

The Administration has known as short, that the Soviets have been rapidly outdistancing the counts in the ballistic missile race, whose outcome will probably determine the future balance of world power. And that is where cut out-of-the-bag No. 2 comes into play.

FOR CAT NO. 3 involves the Administration's reaction to the Soviet missile test in the Tashkent region. This act a complete little lie and is out of the bag in itself.

The Washington Post, for example, reported an order by former Secretary of Defense Charles Wilson which had someone set research and development work length in months by some \$10 million.

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For example, when only in July it was reported in that issue that the Soviets had achieved a successful test of the IRBM as far as Tashkent, which is also a center of the Soviet Service Cosmonautics, and that the acts with the highest Strategic importance. He was further reported that it was achieved despite the fact that the radar tracking station had by that time recorded a number of Soviet IRBM tests.

All in all, Administration spokesmen failed to hardly before the managing committee are going to have to do more full explaining. The facts, of course, are not all on our side. The spokesmen of the Administration can, with perfect grace, for example, that there was no serious missile program at all in the Tashkent area, which is a reason reason why this country is so frightened by the Soviets in the missile race.

And yet one thing is already clear. The Soviets, in a visible model of the Soviet technological lead has suddenly and sharply raised President Eisenhower's reputation for allowing weapons to defense nations. The reputation has suddenly prompted the Administration's

defense policies from politically effective criticism—is reflected in the board rooms which passed the unusual resolution before the Strategic Arms Control last year.

Now, thanks to Sputnik, defense is more to be a cause political issue, and the subject of a major national debate. And that, in a democracy, is precisely as it should be.

Sputnik and Secrecy

The Hartford Courant

From time to time the American people have been given bits of information, whereas known as the people's right to know. Naturally they are not, but they hardly get named about it. Mostly, no doubt, they put it down as a matter of newspaper writing to get more space, so that they can sell more papers.

Actually the Public's right to know is the foundation for self-government. Freedom without knowledge is as foolish as it is. How can the people govern themselves if they don't know what is going on? In Soviet Russia, as far as that has relevant information reaches, there is no secret technology—every one of us has had an equal chance to obtain it, even if we do not know what we are doing. Sputnik has changed the attitude of the world toward us and has, indeed, changed the world we live in.

Yet this shock was largely unnecessary. It wouldn't have happened if the American people had known what was going on. For years newspapers and scientists have been boasting as the dooms of the Pentagon with a plan that the American people be told short their military strength, especially as regards atomic progress. But the doors have been closed. To this day we keep them closed to the point of alliance. For example, at considerable cost the government has Soviet scientific and other publications, which are sent to the Pentagon for translation. But, over translated, they are classified by the Pentagon—and so kept secret from the very systems of national intelligence as well as who could learn from them and so help us to defend our vigor.

Meanwhile the Pentagon insists that everything is secret, that our soldiers, hardware, tactics along lines. In general, it sets on the premise that anyone outside can overtake us. It was through the blind burst of confidence that built up that Soviet, came reading, keeping the war at 10,000 miles in back. And now we have another in the long series of shocks that have followed. Aviation Week has published the news that, for more than two years, the United States has been losing about 500 aircraft in combat to Soviet planes, though both governments are acknowledged neutral. We have trusted the number as they are fed with Soviet Rumors, such as exceptionally powerful radar systems set up in Turkey. In a critical magazine argues that this belated secret fact is not really a secret at all—but anybody except the American people, who we must really affect by it.

The Russians have known about it for some time and have a little less to do about what they are already doing—therein Turkey where this radar equipment is located. We have known about it for years, though a vast. None of this operation can be observed in America's skies, Pentagon considers. Los Angeles cocktail parties and aviation professional meets gatherings. Bits and pieces of the story have already appeared in public press of several nations.

Saying about things that everybody knows except the American people helps explain the little sense of surprise that has been arising. And in that little sense of surprise it has been possible for the Defense Department,

the after fits and starts, after weeks, to knock off one after another source items that have ended up our strength—if the news items research in pure science to approach to industry division is being.

No doubt the cutting of military expenditures has noted the national temper. We have shamed for income. We have wasted nothing as much as to let alone in power, to enjoy and develop still further the highest standard of living in all nations. The trouble is that Khrushchev & Co. just aren't going to let us share in peace.

* * *

And now, in the minds of the whole world, the technical leadership that since second world war drove right has been matched from on. No doubt we are far behind till today than the rest of the world with that. The trouble is we don't really know. What the other nation demands is leadership—leadership that will tell us the truth, and thus tell us what to do. The American people will respond.

'Security' Can Be Suicide

The Wichita Beacon

Elsewhere on this page we repeat an editorial by Robert Blotz, editor of sophomore Aviation Week magazine, which questions the wisdom of keeping secret from the American people the facts about the development of Russian missiles, satellites, etc.

All of us who write for the public press have at times come into conflict with the broadened bounds of certain non-war-winning types of nuclear shots.

At the beginning of the B-52 program here during World War II, the word was "keep quiet." About a third of the adults in Wichita were helping to build the machines. The little children watched them as they flew over the city and said, "Look at the B-52!" Presently the balloons were exploding like crazy. And so last the military released the publication of information that somebody could find an "S" on. Some documents may have ruined the theme of war. The government did not, however, say any thing except to guide the variety of the reader.

In present time this is something unusual about such unwiseable censorship. It is dangerous for no reason.

1. When accurate censoring progress of the enemy, lack of knowledge on the part of Americans and their congressmen can erode a fool's paradise. Americans have a right to know the circumstances of the dangers that threaten them.

2. When secrecy involves our own progress, lawmakers, scientists and the general public have no sources of information. They do not know whether the country is defended well or both. They are not so good of deciding whether man or his material is the greatest threat. And researches are not made to obtain the status of our weapons.

There are, of course, facts which must be stamped. "Top Secret" No doubt has been warped with the concept of true security, security. The danger lies in the fact that certain types of strongest military gases do not seem to realize that they are accountable to the American people and that this depends on the American people for its operation.

An Insult to American People

The Milwaukee Journal

Certain comments of the Secretary of State in his latest news conference should not go unnoticed or challenged. They are as insult to the American people.

Doubts and that the Russian satellite is a useful thing if

it occurs "the whole country" to the importance of the nation's missile program. He indicated that the Administration had reduced of along the importance of missile and the degree of Russian advances in the field, but that Congress and the people were generally not aware of the problem at the moment.

There is, of course, growing doubt that the Eisenhower Administration did reduce the importance of missile and the fact that the Russians were moving ahead. But of this, the other John Foster Dulles.

Now we would like to make the point that if the American people were not made to mind problems the blow rests probably with two men. One is Dwight Eisenhower. The other is John Foster Dulles.

Who has either advised the people as to the importance of the missile program? Who has either warned that the missile program was lagging or that that would worse names to spit on? Who has either tried to sit public owners to promote out the Russian advance?

It is the terribly tragic truth that Eisenhower and Dulles, by and large, have sought to tell the American people, em-

sive them that everything was under control, and assure them that the United States had the best of foreign policies, defense programs, weapons and leadership.

For five years, the American people have been fed little but bland statements, pallidian optimism, poor platitudes and double talk supervised by sound public relations experts. Americans, along with the people of the world, have been sold over and over again of that come by now very familiar lie that America is superior, dominant and omniscient, invincible and patriotic genius and is invincible right in world leadership.

So if any wonder that American people have been complacent? Is it any wonder that are dazed when they hear that the so-called "hard-hitting" have revealed them as a major scientific development? Is it any wonder that there is mounting anger and questioning because it is not an American satellite coming over our heads?

And how shockingly stupid that, at such a time, Secretaries Dulles, of all people should try to convey the impression that it is "the people" who are to blame for the situation in which the nation now finds itself!



Hawk Displayed on Loader

Trucking and guidance radio data and sonic discrimination loads (right) for Army's Black missile. Designed for use against low flying aerial, Black will supplement Nike ground-based missile in the country and will be used to defend tactical units in the field. Black reportedly uses Doppler radio techniques to discriminate target from ground clutter and for successive terminal guidance.

Sputnik Is Radiating Strong Infrared Signal

Cowley, Mass.—Despite that the Soviet earth-orbiting satellite has already crossed the equator, it is reported to have radiation outputs on expected as a result of detecting astronomical infrared signals for ICRF defense. Reason is Sputnik's strong infrared radiation is not fully understood.

Belately crude infrared radiometric equipment, kindly applied to the test, has previously detected the Russian satellite on a number of passes over the Boston area during the last several weeks. Semiconductor visual applications of infrared detection of infrared radiation was the technique.

Infrared sightings of Sputnik were made by Michael Shaw, head of Black Associates, an infrared consultant in Massachusetts Institute of Technology's

National Superconductor Laboratory and Air Force Cambridge Center. Several companies, including Bendix, Aeromet, Barnes Engineering and General Electric, reportedly are following Black's development and establishing definitive results.

Initially Sputnik's infrared radiation was attributed to reflection of infrared radiation from the sun and/or due to infra-red heating of the nuclear shell. However, Sputnik continues to give out infrared radiation at night long after its solar panels should have folded and when there is no obvious source of solar energy. Radiation intensity is higher than reported from any or all known sources, prompting some scientists to suspect a hitherto unknown phenomenon, Black told *Aerospace Week*.

Owing to the source of Sputnik's radiation has now been ruled out, Black and others began to make spectral analysis of the measured radiation. Radiometer used by Black employs a sealed lead sulphide detector which is sensitive only at shorter wave lengths, out to about three microns. Use of wide-range bolometers for type detection will permit more complete spectral analysis.

Radiometer used in Black's equipment has a field of view of about 10 degrees, a 2-degree solid angle, with the long axis set at right angles to Sputnik's predicted flight path. As satellite passes through the stratosphere for a brief interval, its infrared radiation is recorded on an oscilloscope simultaneously with a test signal from National Bureau of Standards radio station WWV.

Infrared satellite sightings are not possible with existing equipment, when it is a comet. The inability of it is hard to penetrate heavy comet dust and ice. However, for ICRF defense, infrared detection equipment could be installed as an infrared vehicle designed to operate at high altitudes.

Sputnik May Spur Overall Defense Probe

By Katherine Johnson

Washington—Sputnik earth satellite publicity will lead to congressional action to boost the funds of prodding the military and missile programs. There was no doubt about it.

• Sen. Lyndon Johnson (D-Tex.), Senate majority leader and chairman of the Appropriations Subcommittee, expected to take the lead in evaluating the whip and whereabouts of the Soviet triumph, directed "as soon as possible" a thorough investigation of the launching system that also had to do with what went wrong.

• Rep. George Miller (D-Tex.), chairman of the House Appropriations Sub-committee on the Armed Services, expanded plans for a Senate hearing in the field of the missile program. The subcommittee will start its closed-door

session in Los Angeles with Maj. Gen. Bernard A. Schriener, commander of USAF's Air Research and Development Command's Relativistic Atomic Division, and William M. Haskins, special counsel-nuclear adviser to the Secretary of Defense.

• Sen. Estes Kefauver (D-Tenn.), most active member of the Foreign Relations Committee, called for a further robust-level scrutiny to assess all scientific research and development.

This is a recommendation that also has been made by Sen. Mike Mansfield (D-Mont.), Senate majority whip (AW Oct. 28, p. 29).

Sufficient Statutes

In line with the widespread cabinet-level scrutiny to oversee all Kefauver committee's "The Navy and

Air Force are trying for the top responsibility. Over there, the Secretary of Defense has been the supreme authority, but the program itself and satellite is not his principal responsibility and he is not thorougly familiar with it or enough in basic research."

"Furthermore, our program is an inter-service venture, so both the Air Force and the Navy are principally interested in military development."

"Therefore, one of the first things we should do is get our program off the ground—a place within the government's chain of sufficient stature and power to command respect."

After West Coast conference with guided missile contractors, Miller's sub committee has scheduled a closed-door session with Secretaries of Defense Neil H. MacAvoy and Deputy Defense Secretary Donald A. Quarles on Wednesday Nov. 20 and 21.

The group will then proceed to the Redding, Ariz., area.

Over the past year, Miller has been in the forefront in the mounting congressional clamor for less suspicion and less dollar "waste" on the missile program (AW Mar. 16, p. 30).

What Johnson Wants

Sen. Johnson reported the four questions he has directed the staff of his Preparedness Subcommittee to answer in the hearing for added congressional hearings. They do not list the Senate approach Bill title:

- "Could we have matched the Soviet achievements?"
- "Would it have been worthwhile to match the Soviet achievement?"
- "Does the Soviet satellite indicate that this country has slipped behind in the development of its defense?"
- "If so, what do we have to do to catch up?"

The statements of Sen. Johnson—chairman of the general congressional committee against increased defense expenditures—

"The mere fact that the Soviets can put a satellite into the sky does not alter the world balance of power. But it does mean that they are in a position to alter the balance of power. And they will do it if we remain where we are. The satellite may be little more than a nice toy, but a nation that can produce such a toy can produce anything else that a conceivable. We want to make sure that the Soviet Union can produce any basic air, rocket, and aerospace that we can produce. It is only a question of time and which one can get the much of a question."

"There is no point in spending more money unless we feel know that the

missiles already spent has been used wisely. And there are certainly ample grounds for suspecting that some serious errors have been made."

The missile program, Johnson continued, "has been the subject of massive kickbacks along the three major launching sites—space battles fought with all the Soviet agents—although not the bloodshed—of war itself."

"It can be said that that country can as well as produce the satellite. But certainly, the armed services were engaged in a race with each other to develop the guided missile. And we cannot afford more, more races like that."

The independence that was accorded the three branches was not intended to be an invitation to waste money. And while war is the one consuming theme that seems to run through all the proposals,

Without passing judgment on the changes and disagreements among the services in missiles, Johnson concluded:

"It is clear that the people working on missiles needed reeducation to each other."

"We will be able to solve the problem of the satellite and the missile needs of current war with together with cooperation in the underworld. And this represents the social security defense since that will be before Congress in the months that lie ahead. We will have to find ways in terms of bringing some unity and not weapons development program. We cannot prevent the going to extremes."

Air Force May Split Production of WS-110

Washington—Air Force contract #N 1101 chosen bidder competition between Boeing Airplane Co. and North American Aviation Inc. can be decided because of the long-standing Air Force fact it doesn't want the complete job still on the winner on the horns that that would give the winner, starve the loser.

Under that theory, the winner would have maximum responsibility for the weapon system along with the bulk of the project, while the loser would get a good part of the detail design and production.

Another influential factor, bothering high Air Force officials is the question of the number of WS-110 bombers that could be put into production, since the cost of producing the high flight performance aircraft is high. The cost of the bodies of new manufacturing techniques may involve a price twice that of Boeing B-57.

Both North American and Boeing WS-110 designs contain a considerable amount of high-temperature materials



Another Thor Fired Successfully

Air Force Thor missiles launching pad at Cape Canaveral. On its third successful firing, the Douglas intermediate range missile came down a forty of miles seawards at the Florida line (AW Oct. 16, p. 29).

construction—North American featuring stainless steel lower cone panels. Boeing features aluminized mylar panels.

Cost of the construction runs 14%

Pied Piper Propulsion

Lockett Pied Piper advanced propulsion system selected AW Oct. 14, 1958, in which the two Convair Advanced Propulsion teams, which entered the competition, were selected, in the initial lowest stage in the path to exploring space.

Also, with an liquid oxygen/liquid hydrogen—or ethyl alcohol oxygen—most of two booster plus interim with all four boosters built around a liquid oxygen/powder fuel system with a first stage rocket pushing as the main the retro-mounted ethyl alcohol package carrying a television camera, optical sensor, radio and infrared sensor.

Firing of booster into space would not necessarily have to occur a completely operational. Also, which is normal development, would be extensively tested and dependent on complex system of ground supporting equipment.

high G Convair's B-58, there are 260 stainless steel honeycomb panels totaling 1,082 sq ft. Cost of this can structure, unplied, runs between \$200 and \$300 per sq ft, depending upon the type of panel used.

Convair's cost of the upper fuselage section of the aircraft, of stainless steel, is \$300,000. The upper fuselage is considerably greater than the B-57. Approximately \$31 million has been spent on development of stainless steel honeycomb panels, including predictable inflation, for the B-58.

Benefit of this equipment could be translated into the WS-110, but a considerable amount of research development work would still be involved.

Convair, in addition to the potential high-temperature strength of the ethyl alcohol oxygen, is also adding in costs of new designs such as first illustrated in the WS-110 program. Engineers close to the project say the temperature-growth factor may never be achieved and should be minimized wherever possible to fit operating conditions which may be expected early in a reasonable span of time.



Vanguard Launched at Cape Canaveral

Vanguard TV-2 test vehicle is fired at Cape Canaveral, Fla., to test the Grumman B-57B test stage engine for the satellite project (AW Oct. 16, p. 25). Vehicle reached 109 mil altitude with speed of 4,200 mph during 140 sec flight.



Kaman Unveils HU2K-1 Utility Helicopter

Kaman Aircraft Corp. exhibits a full-scale model of its first single-rotor configuration, the HU2K-1, at the company's plant in Bloomfield, Conn. The helocopter design was selected by the Navy Bureau of Aeronautics in a competition for a utility helicopter (AW 100 p. 22). The HU2K-1 will be powered by a General Electric T58-GE-10 engine. Kaman's HU2P-1, a two-rotor helicopter powered by the Wright R-1820 engine, was entered in early contests by Bell and Sikorsky.

Polaris Begins Underwater Tests

Washington—Polaris underwater missiles are being evaluated to determine the influence of currents and other physical phenomena affecting launching conditions from submarine or ship board. Testing for the Polaris was recently completed (AW Oct. 28, p. 30) and Navy hopes to fix a reasonable complete configuration within two years.

Polaris will be about 47 ft long. It will carry an Avco-Lytton solid propellant rocket 35 to 40 ft long weighing between 34 and 44 lb in diameter and weighing approximately

20,000 lb. Rocket burning time will be about 15 sec. Thrust will be about 190,000 lb at sea level. In addition to Polaris, the division has about 15 other missile projects, some sponsored by military and others research and development projects, by Lockheed.

Soviets Scorn Farnborough

Microscopic visitors were not greatly impressed by the aircraft and missile displays at England's Society of British Aircraft Constructors display in September (AW Sept. 9, p. 16), according to the official U.S.S.R. Defense Ministry newspaper and state, *Iskra*. In a report on the show, the Soviet publication declared,

"Overall, the Farnborough exhibit demonstrated that British industry has the potential to manufacture nuclear-type weapons equipment and can, under certain conditions, be a user for us," adding, "this equipment is other capitalist countries."

The show also indicated that the British aviation industry still lags in solving many technical problems and needs to establish business contacts with other nations.

The "other nations" obviously refers to countries in the Warsaw Pact.

But *Iskra* concluded that a Moscow delegation was most recently invited to Farnborough this year, although it had been in 1958. It said, "Recent from visiting the exhibition during the last four days, our engineers were only allowed to attend when the exhibition was open to the general public. This measure, demanded by the hosts of the British aircraft industry, are unwilling to improve the Soviet contacts established by us through the exchange of various specialist delegations between the U.S.S.R. and Great Britain."

Suborbital and Polar Atm. Craft, shown at a research to boost commercial aerospace flight to about 60,000 to 10,000 lb payload of 1918. In addition to Polaris, the division has about 15 other missile projects, some sponsored by military and others research and development projects, by Lockheed.

French May License English Thunderbird

France—Production made license to France of the English Electric Thunderbird surface-to-air missile currently is under study by the French Air Ministry.

Interest along shown by the French in the British missile, together with confirmed reports of recent French requests for information on American intermediate range strategic missiles reflects growing French fear that their nation is falling behind in missile development.

Thunderbird is in production for the British Army and Royal Air Force. The rocket-powered missile is boosted off a launching device by eight boosters in four jets. Thunderbird missile potentially would replace the French ground-to-ground Fava on which the French reportedly have spent \$35 million.

If the French Air Ministry decides to place an order for the Thunderbird, the missile would be built in France by Sod-Airborne. Talks between this French company and English Electric should be in progress and a special commission from Sod-Air is due to go to England later this month.



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PRODUCED AS A PUBLIC SERVICE BY DEFENSE & GOVERNMENT INFORMATION

AIR TRANSPORT

Defense Attacks CAB Airspace Program

Legality of plan to delegate airspace authority to CAA challenged; "over-hasty" action is charged.

By L. L. Doty

Washington—Defense Department attack on a Civil Aeronautics Board proposal to resolve the bitter conflict between military and civil aviation over the allocation of airspace has thrown the controversial issue into a new light.

In a sharp criticism of the Board's plan to delegate authority to the Civil Aeronautics Administration to stage air traffic control (ATC) at 40,000 ft, the Defense Department called for the cancellation of both the CAB and CAA in revised airspace allocation. It also questioned the outcome of any associate areas in the use of airspace that would patch up "over-hasty" action.

Defense stood alone in its opposition to the plan in formal comments filed with the CAB. All other aviation interests were either won to highly enthusiastic in their support of the Board proposal or, in effect, were unjoined in the CAB's determination to discontinue restricted areas and revoke or modify present restricted areas when a "need to switch to flight control."

Defense Charges

Here are the industry's charges against the plan:

* Proposal would disrupt natural pattern of government for handling the airspace allocation problem and "would substitute a completely unacceptable alternative."

* Proposal using would distinctly depart from long-tried principle that certain areas must have authority to decide how to use traffic only when it has been determined that non-emergency is required as the intent of national defense and advance notice is given in the administrator.

* CAB and CAA are without legal authority to add to the problem because they are statutory agencies. Congress intended hence the offices would "exercise as the self-recognized responsibility of the President under the Constitution." Defense argued that the plan was not in accord with the intent of the President expressed in the 1946 executive order which established the Air Conditioning Committee. It charged that the CAB proposal was planned without "adequate consultation with Congress."

* Proposed ruling is not in the public interest since it would give "important

military decisions in the hands of agencies without special competence" in military problems.

The main test came to a head on July 30 when the Civil Aeronautics Board distributed a proposed rule-making that would make the rights of the aviation services to divide large areas of the sky for flight control by non-military aircraft, commercial or otherwise, available to the national defense. Effect of this ruling would be to strip the Air Conditioning Committee of its power to handle airspace differences.

Public Meeting Planned

Because of the violent protests by Defense and because it was forced the states would become bogged down in a dispute on legal intricacies, the Board will hold a public meeting on the issue. When and where depends on the decision making of the agency.

Defense stressed that the deadlock can be broken once technical difficulties are ironed out.

Civil Aeronautics Board still stands fast in its opinion that its station authority to control airspace rests in Title VI of the Civil Aeronautics Act of 1938 which empowers the Board to promote safety of flight as it conceives by prescribing rules and regulations governing flight, navigation, planning and construction of airports. Title I of the Act makes no distinction between military and civil interests in the definition of "air transportation."

A spokesman for the Board told Aviation Week that the authority is expressed in present Civil Air Regulations but has never been drawn upon since the Air Conditioning Committee has shown that a civilian job. He added however that conflicts between ATC's capability to handle air traffic by non-military aircraft and the conditions of CAB's airspace provide for further distribution of space for aircraft or restricted areas without some give and take.

Under the Board's proposal one that its proposed amendments to the Civil Air Regulations were designed to clarify the intent of the Board in providing for delegation of the air traffic rules by severity of the armed forces. It said the provision was originally intended to allow military aircraft to communicate with the rules of performing no two missions and to allow complete

freedom of action in the defense of the U.S. It added, however,

"It was never intended that this section would be used to justify non-compliance with air traffic rules in such operations as conducting training activities."

The Board has emphasized that the problem of dividing airspace has come to be "acute" involved men too no longer be accommodated. It said that in the past seven years, total airway mileage has doubled and the nation has made significant improvements in military purposes at increased costs than 50%.

To demonstrate the effect of restricted areas on the planning of high altitude, transoceanic flights, the Civil Aeronautics Agency early this fall prepared a chart through the Coast and Geodetic Survey depicting the wide sections of airspace under military control. The chart detailed an overlapping of many restricted areas and the decision-making of airspace required to end those areas.

Defense Department maintained that a public perception of the airspace drama on the part of untrained people is a open to bad publicity used to allieviate public apathy and concern. It added that it had no desire to de-emphasize the problem and compromised the CAB by attempting to prevent the situation in visual form.

Admitting that U.S. airspace is over crowded, the Defense Department and both the CAB and CAA agreed when D. B. Aldredge, the Board's general manager, spoke at a press conference last week, that "most of" the present time and called for an orderly review of the policies changes that would be involved in making permanent organizational changes.

Precipitate Action

It cited the Carter plan for immediate funding (AW Aug. 26, p. 48) as having forced a hasty and incomplete compromise. It also noted that the administration had not had time to review the Board's administrative task, "paramount value with which we are concerned."

Under the proposal of Edward Carter, federal participation role for military facilities, a Federal Aviation Agency would enhance all services now undertaken by present agencies except non-military capability powers of the Board. But it will be at least three years before the new agency is formed, the Air Transport Association, who argued that the Carter proposal fails to solve the immediate airspace problems, is urging the immediate creation of a civil air traffic commission to take over (AW July 13, p. 30).

The Defense Department, in its esti-



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should assess some portion of its earnings for growth and as we move ahead on a rotation of a percentage of earnings for this purpose. Ability to sell equity-type securities is another test of a healthy company or institution and one of the factors which induced the President to lend to certain airlines was their proven ability to raise additional capital.

"However," he added, "it is obvious from the stock market record of the last 15 months that equity investors are dis-

tracted by the failure of earnings power to follow the continued increases in fuel, to the extent that, at present, the change in using additional equity is not at all favorable. Should the ability to raise this equity be lost because of financial mismanagement, the industry would be in trouble."

Other interesting testimony along similar lines include James P. Mutual, Chase Manhattan Bank vice president and Frederick F. Rehman, president of the National Assistance Corp., an investment counselor.

American Airlines Needs Fare Hike To Cover Additional Jet Purchases

By Cleon Garrison

New York—American Airlines wants to buy 45 additional jets to provide an almost 40 percent increase by 1961, but will need a 35% fare increase to handle the financing according to C. B. Smith, president.

Flight time, long-haul and 25 medium jetliners would cost \$200 million with related ground equipment, Smith said, and the program will depend on strong earnings of \$75 million. To accomplish that, the airline needs a rate of return of about 12%, the maximum amount of 1959. The additional fares would finance the increase. American's operating costs as a percentage of operating revenues must be held to 95% or less of total.

American's progress and problems were discussed by Smith in testimony filed but not used with the Civil Aviation Board in the passenger fare increase investigation case (AVC Oct. 7, p. 38) and were completed by him at a press conference here last Monday.

Against said the airline's large number of routes, a relatively small number of passengers carried and a "downward trend in the overall economic cycle" the fare increase would pay off unless we meet these obligations to the public," Smith said.

Borrowed \$135 Million

The airline already has borrowed \$15 million to finance its previously-ordered turbine fleet of 28 long-range Boeing 707s and 35 Lockheed Electra turboprops.

No decision has been made on which jets would be bought for the second fleet, Smith said. But he said plans for the 45 new planes may well be additional Boeing's. For the medium range jets, those appear to be between the Convair 880 and Boeing 717, he added.

With enough jets and turboprops

and aircraft equipment modernization programs.

The second plane cannot be put into effect, however, unless the airline can find a source to finance it. Smith said he told the CAB that there was no worth of the jet in 1958, that there was \$80 million in it and it will be very little worth as of the end of 1959.

At present, however, the airline will suffer a loss in 1959 after payment of interest. One cash flow through 1960—apart of present fuel levels, and now without dependents on additional equipment orders—would bring in 16 percent net profits. By the end of 1959, current liabilities will probably exceed current assets, resulting in a negative working capital position.

The rate of fuel cost will still point to the need for additional capital to finance the obvious consequences of the financial plan, he said to a reporter. He said we will need the extra resources to provide us with 5200 units of new aircraft and ground facilities by the end of 1961."

The general facilities, Smith stated at the press conference, would account for about \$25 million of the total.

Regarding financing of the current turbine order, he said \$135 million was borrowed through four finance companies in 1955 from Minneapolis Trust Investors Co. and another \$135 million will be borrowed through the public offering, he pointed out here.

• Total jetliner capacity of 127 billion seat-miles will be required by American in the end of 1961.

• Segments of 500 mi or longer will require 9 billion seat miles of capacity, and over 4 billion of this will be on our 360 mi segments.

• Average new jet order will produce less than 5 billion annual seat miles. If these jets were used only on segments over 360 mi, they would fall far short of the capacity required for these non-stop flights.

With the first new jet order, Smith said, American could provide enough jetliners to carry 10 billion on its system.

With the additional jets, such service can be extended to a total of 25 cities by the end of 1961.

At that time, "conservative assumptions" indicated annual net earnings after taxes and interest of \$100 million through 1960 and \$150 million annually thereafter at about \$1.52 per share.

On the basis of American's present position, as ratio of debt to total capital will stand at over 60% when the new aircraft capacity increase has been completely absorbed, interest charges, which in 1958 were \$600,000, will be \$20,362,000 in 1960, and when payments on principal of the loans begin in 1967, annual required payments with interest will be over \$10 million.

Smith said the general economy

Air France Borrows In U. S. for Jets

Paris—Air France will get help in financing its Boeing 707 jet purchase from Boeing Aeroplane Co. and United Aircraft Corp. in addition to the Export-Import Bank and three New York banks. Arrangements make the first time the French state airline has borrowed money in the U.S. for aircraft.

Coupled around 12 long range Boeing in 1960 and seven more next March, Total jet plane requirements in 1967 will be 1400.7 million.

The defenseless French government won't be in a position to help out as airline, yet Air France had to find the money or lose its delivery position for the aircraft.

• Air France now plans to pay for the 17 planes by borrowing \$46 million from the largest Bank of \$15 million others from the private banks, at interest of 5.5% with the latter to be paid off within seven years. Boeing and United Aircraft, the regular suppliers, have agreed that Air France may prepay principal of \$17.5 million due them as delivery of aircraft. Air France will put up \$24.2 million to make up the total.

Long distance plus regional and Field charges plus expanded ground facilities such as terminal buildings and maintenance bases will total \$16 million in 1960.

The carrier's present DC-8 fleet pays a substantial financial risk. Smith said if these aircraft were depreciated automatically over seven years with 10% residual, maintenance costs by the end of 1960 would total \$13.7 million "at a time when they have become non-plant assets."

• Early segments of the airline's east coast fleet will initially share plane parts but eventually assume full ownership. This will reduce the maintenance workload resulting of 1949 since a bottom," Smith predicted.

American has adopted a depreciation policy which relates to the lives remaining after taxes and interest of \$100 million through 1960 and \$150 million annually thereafter at about \$1.52 per share.

On the basis of American's present position, as ratio of debt to total capital will stand at over 60% when the new aircraft capacity increase has been completely absorbed, interest charges, which in 1958 were \$600,000, will be \$20,362,000 in 1960, and when payments on principal of the loans begin in 1967, annual required payments with interest will be over \$10 million.

• Trouble with the general economy,

Smith told reporters at the conference, is something more than a "working crisis." All business is likely to enter the program to what reduces it had. But he said he thought the Board will be reasonable.

The airline's program would not much affect the airline's other division, the passenger airline, for competitive reasons. Smith said, "but it is being made public because there was no other way of letting to CAB the falter realization of American's financing problem."

Regarding rates at 1600—where the jet-a-jet price was set at present mixed levels—Smith said the revenue team had spent a lot of money on options and had to pay what could also be reduced. Quantities remained, he added, as to how much price reduction should be enacted in September.

Smith said he believed the airline would be able to meet its targets by 1959, although he couldn't be sure. "Appropriate levels" review the same basic to American that it does to Port of New York Authority Executive Director Arthur Tribus.

• Regarding rates at 1600—the jet-a-jet price was set at present mixed levels—Smith said the revenue team had spent a lot of money on options and had to pay what could also be reduced. Quantities remained, he added, as to how much price reduction should be enacted in September.

Washington—South African has decided that it is ready to negotiate a bilateral air agreement with the U.S. for direct airline service between South Africa and the U.S.

• G. N. Zanzibar, the Soviet ambassador, made the proposal here during negotiations with State Department Special Assistant William S. B. Lucy on the expansion of exchange of ideas and information between the two countries in a prepared statement. Zanzibar was born in 1905.

• The Soviet said it was ready to reach agreement in principle on the establishment of direct air communications between the U.S. S. R. and the U.S. A. on the basis of reciprocity.

Indication that Russia would sign a bilateral agreement with the U.S. was disclosed in an AVIATION Week interview in Moscow last year with Major Gen. Belenko, operations head for the Soviet forward airbase Avia Base No. 1. Vice Minister Defense, Gen. V. V. Kozachenko, director of the country's Strategic division (AVW July 9, p. 36).

At that time, Gen. Belenko told AVIATION Week that Aeroflot would enter transatlantic competition in about two years when either the Tu-104 freight transport or a large turbo prop became available. It is possible that the Zanzibar announcement was made as a prelude to Russia's new 70-passenger, long-range turboprop Basayev transport (see p. 34).

In August, 1956, a Pan American

The American official said that if CAB didn't grant the fee increase, the airline would probably have to reduce its program to what reduces it had. But he said he thought the Board will be reasonable.

The airline's program would not much affect the airline's other division, the passenger airline, for competitive reasons. Smith said, "but it is being made public because there was no other way of letting to CAB the falter realization of American's financing problem."

Stanley Gewirtz Resigns National Vice Presidency

Moscow, Feb.—Rearguard of Stanley Gewirtz as vice president of National Airlines was announced last week by G. T. Baker, president and board chairman.

Gewirtz is a former vice president of Air Transport Association and executive assistant to two chairman of the Civil Aeronautics Board. He told AVIATION Week his vice post will be succeeded at a later date.

World Airline contingent visited Aeroflot officials in Moscow on its return to the association to discuss Moscow operating rights for Pan Am (AVW Aug. 22, p. 21). Negotiations were stalled and have not been resumed.

Gen. Belenko explained during the AVIATION Week interview that Aero's bilateral policy is based on reciprocity, and the Soviet airline officials in Moscow are in contact with a group of traffic rights. The trading program emphasized routes in North America, Western Europe and Asia.

Russia Suggests U. S. Bilateral

Washington—South African has decided that it is ready to negotiate a bilateral air agreement with the U.S. for direct airline service between South Africa and the U.S.

• G. N. Zanzibar, the Soviet ambassador, made the proposal here during negotiations with State Department Special Assistant William S. B. Lucy on the expansion of exchange of ideas and information between the two countries in a prepared statement. Zanzibar was born in 1905.

• The Soviet said it was ready to reach agreement in principle on the establishment of direct air communications between the U.S. S. R. and the U.S. A. on the basis of reciprocity.

Indication that Russia would sign a bilateral agreement with the U.S. was disclosed in an AVIATION Week interview in Moscow last year with Major Gen. Belenko, operations head for the Soviet forward airbase Avia Base No. 1. Vice Minister Defense, Gen. V. V. Kozachenko, director of the country's Strategic division (AVW July 9, p. 36).

At that time, Gen. Belenko told AVIATION Week that Aeroflot would enter transatlantic competition in about two years when either the Tu-104 freight transport or a large turbo prop became available. It is possible that the Zanzibar announcement was made as a prelude to Russia's new 70-passenger, long-range turboprop Basayev transport (see p. 34).

In August, 1956, a Pan American

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and the author's address at the end of each article.

Airline Revenue Regulations Denounced

Dr. Fred Eastman

Washington—Federal regulation of commerce is as industry with the economic characteristics of U.S. domestic airlines as it is in the public interest, according to a study made by Herbert A. Johnson, president of Pan American World Airways, Inc., and published in the *Journal of Business*. The study, which was prepared for the Interstate Commerce Commission, concludes that the regulation of commerce produces a substantial increase in the "margin of return" and a substantial increase in the "rate of return."

"Although air transportation is no more capital intensive than railroads or pipelines, some inc. charges or services appear anomalous but that the rates should bear an appropriate relationship to the expenses incurred. Although capital employed and annual expenses may both increase, capital employed

B. Domé, New York University School of
Economics, economics professor.
The conclusion was drawn from an
analysis of economic standards applica-
ble to the types of transportation
services provided by the Civil Aviation
Authority Board as an exhibitor by Rosters
As Low as the Lowest Domestic Passages
Investigation.

The increasingly important element in the
nation's economic pattern and shape-
pers of freight traffic can also change
other areas of interpretation. There-
fore, the analysis must be more
closely applied to the problem of freight
in terms of the interests of users on
one hand, and the properties of the
people for whom the road is intrinsic
to their needs. The longer term investment
expenses at the shorter term or annual
investment.

Role of reference which is the most
important, useful and reliable. Domé
distinguishes between the nature and
characteristics of the class or type of
enterprise.

Both the capital investment and the

The exhibit is more of a poster than the one in the original.

business economies than the type significant differences between a *Corporation* and *Proprietorship*. In this study, however, no results were found for *Proprietorship* on monthly basis. The analysis explained certain characteristics associated with one type of business as compared with another.

Secondly, for this he said, are that the characteristics of these entities are the opposite of those in the air transports—*i.e.* no salaried—exclusive legal control of the market, the degree of mobility of assets and the general controllability of alternative means of getting a substantial revenue.

Barriers/Concerns

On the basis of the occupational analysis, Brown concluded that

- * There is no state or federal regulation of fares to protect the public against exorbitant rates, penalties become of the leveling effect of competition between carriers and between railroads and other modes of transportation.
- * So long as fares are regulated and a carrier is not compelled to compete with other carriers, it can charge whatever it wants.

The non-transportation utility oligopoly independence occurs under conditions which make exclusive control of the market socially most economical. Since sales competitions between two of these industries occurs only within very narrow limits, the industry is a depository open to the service and is not subject to competition and

Safe Margin

It follows, Dennis added, that the use of a rate of return approach to determine regulated utility industries when non-competitive, is logical and appropriate.

On the other hand, the margin of return approach is unfair, discriminatory

In addition, he said, the non-transitory subsidies have a low capital cost, which makes them attractive to government. Therefore it would take very little extra effort to increase the amount of such subsidies.

in seeking economic regulation because prior to and at the time of the Cargill Antitrust Act of 1935, the industry's revenue was wholly monopoly. The economic provisions of the act, he said, were intended during only as a means of stabilizing the strength of the railroads, during the period of destructive competition, until adoption of a system of rates or rates of return by a mail protest.

Most Considerable

If federal regulation of farm contracts according to the individual, it will not be possible to determine a formula for determining the revenue requirements of the air transport industry from the standpoint of the reasonable cost of production of the services.

Besides the high inelasticity of what traffic will be encouraged, capital at fixed, on favorable terms without regard to the past investment, the costs maintained and the revenue distributed. He believes it is important to allow the railroads to earn a profit which will be fair, a rate of return and a reasonably wide range of returns.

In an industry with a very close cost of service, however, the methods and

Uhlen achieves revenue sufficient to cover his costs. Dessa and those other factors involved make it unnecessary to control him. They + Rapid rate of capital turnover, where rates of the surface. Dessa and those other factors involved make it unnecessary to control him. They + Rapid rate of capital turnover, where

The "rate of return" approach, Deom explained, measures that the return should bear on appropriate securities based on 1946-1955 statistics in short-term and the average margin of return is about 13%. In comparison, the track manager 1946-1955 average capital turnover



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During Exercise "Call and Haul" at Fort Riley, Kansas, 15 U.S. Army officers of the 1st Company moved 300 fully equipped combat troops of the 16th Infantry a distance of 25 miles in 80 minutes.

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other was 3.6%. The average margin of others was 3.1%.

With an average margin of return of 3.1%, a 9% discount in cost of a \$10 million investment would reduce the margin and rate of return close to zero. Data on such a large degree of risk coupled with a feeling on days actually indicates such the industry's ability to assess investment at such a low rate.

On the other hand, he added, an transportation officials with a role in the sale of assets and in the long volatile become energy wealth system will make in the face of any price change or increases in capacity. At the same time, he said, the policy appears inherently inflationary, contributing to the fact that revenue regulation makes the chance of price inflation profitable. Investors who feel fairly assured of a continued return within conservative limits and who feel confident that they will not lose their capital in return do not demand sufficient upward possibilities in their return, Dennis said.

Los Angeles Terminal to Expand

New passenger terminal complex proposed for an expansion plan for Los Angeles International Airport consists of 15 buildings of varying proportions on the 300-acre area. Terminal buildings are located around the perimeter of a 5,000-car parking sector. Located on the ramp, and reached by underground tunnels, are the satellite buildings where passengers will capsule and deplane.

Each of these buildings will measure 300 x 175 ft., large enough to cover a football field. The new areas will accommodate 10 gates and 10 jet stands. Satellite buildings also will have 10 plane loading positions suitable for the coming big jet transports.

Each will have another level and a maximum slope grade.

Plans for a series of steps have not been settled, but arrangements for the general scheme likely to be followed

are progressing. Center complex will contain a restaurant, cocktail lounge, coffee shop, employee cafeteria and commercial shops. Spokes leading from central complex to buildings around perimeter are elevated walkways over the parking lot, which is one story below the field level.

First step of building buildings around perimeter are ready with the parking lot, second story in that with the field level. In the first quarter of 1966, work will begin on underground construction, which spans and on preparation of ground. After this, work will commence on building buildings and satellite structures.

Next will come the central area which includes the main buildings and parking.

Pearson and Associates are coordinating architect in a joint venture which also includes architect Wilson Butler and Associates and Paul K. Williams.



Boeing Stratoliner Rolls From Plant

Number one Boeing 727 Stratoliner jet emerged from a rolled-out of Boeing, Wash., Transport Division plant, near Seattle, on Oct. 28. Photo of the 99,210 passenger aircraft shortly before rollout date. The extremely complex plant will undergo final functional testing before being flight tested. The plane will be delivered to Pan American World Airways' delivery in late 1968. (AWW Oct. 28, p. 125). The 727 is expected to have a seating range of 3,000 en. and speed at cruise of 600 mph.



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SHORTLINES

► United Air Lines will begin daily Douglas DC-7 air coach service from Boston to Chicago and Los Angeles on Nov. 12. The new flights, called "Custom Coach," are scheduled to leave Boston at 9:45 A.M. EST and arrive in Los Angeles at 9:25 P.M. EST, with an en route stop in Chicago. The return "Custom Coach" flight, scheduled to leave Los Angeles at 11:58 A.M. PST, will arrive in Boston at 12:14 P.M. EST, flying by way of Chicago and New York.

► Continental Air Lines has doubled its Douglas DC-7B air coach service to Kansas City on the Chicago-Los Angeles route. On the new schedules the airline's "Club Coach" Flight Five is scheduled to leave Chicago deck except Wednesdays at 2:30 P.M. CST, adding Kansas City to the flight, arriving there at 4:15 P.M. CST and continuing on to Denver and Los Angeles. Returning to Chicago, Flight Five will stop daily except Tuesday at Kansas City at 8:20 P.M. CST, continuing on to Chicago, arriving there at 8:45 P.M. The new "Club Coach" service, in addition to the daily stops to that city on Flight One Westbound and Flight Four Eastbound.

► KLM, Royal Dutch Airlines, has increased its cargo operations to Europe, the Middle East and Asia. KLM now has 16 weekly flights to London, seven to major cities in Germany, two to Paris and five to Brussels. KLM also has even cargo capacity of up to \$1,000 lb. a day in air freight, plus twice the capacity to accommodate cargo passenger aircraft.

► Pan American World Airways is completing the purchase of a 20% interest in Philippine Airlines. The purchase was made subject to Civil Aeronautics Board approval of the acquisition of Philippine Airlines president Col. Amado Sison, who allied Pan American to become associated with Philippine Airlines through a purchase of part of his holdings. Pan American acquired approximately 4% of PAL's stock last August.

► Flying Tiger Line expects a net increase in fare revenues for the third quarter of 1957 at \$497,443 as compared with a deficit of \$111,634 for the same period last year. Net income and operating profit for the first quarter were \$1,801,515. Gross revenue for the period was \$9,465,071 over \$5,110,516 resulting from introduction of the new Lockheed Super Constellation on Flying Tiger's route list Jane.

AIRPORT WIRE, November 4, 1957

AIRLINE OBSERVER

► Convair is increasing local service airline interests in a fast-track conversion of its C-74-340-140 series. Most local service carriers are determined to shift to turboprop power when they change from the DC-3 and the route carrier hopes to come as bold on the short-haul market through the conversion. Northwest Airlines already is considering powerplant engine revision of the 410 as a possible replacement for its fleet of DC-3s.

► American's new Boeing, which arrived in Miami last week, is based at Miami International Airport to start the 100 New York City sales runs. Price of the plane is about \$3.5 million. Second Boeing is due in Miami in two weeks.

► Airlines stocks doggedly continued to lag within a few points of 1957 low despite the recent and widespread upsurge of market prices. Elsewhere, as the market slipped back to lower levels last week, however, oil price shock was again a new low for the year with avoided.

► Russia's new long-range Kosygin turboprop transport scheduled for delivery in the near future is expected to make sharp inroads in trans-Siberian air travel. Soviet Air Force Major Gen. A. Mikhalev, in a 12-passenger Kosygin, operating only 100 hr. a month on the Moscow-Vladivostok route, will be able to replace 16 trans-Siberian passenger liners.

► Trans World Airlines' pilots have been given a new year in operational norms under a pilot introduced by President Carter Beauford, who said that pilots are given a fair chance to participate in company decisions on flight time schedules.

► Lack of senior analysts has forced Civil Aeronautics Board to go against its own wishes and defer the local service rate of Return Case. The Board denied an earlier hearing counsel request for deferral on grounds that the carriers had spent much time and money on the presentation of their case and that a further delay might violate the record's "rule." However, hearing counsel's plea that senior analysts who were to be the chief witness had left the Board's employ and that the number of senior analysts has decreased from six to two in less than a year leaves the CAB with no alternative but to postpone presentation date.

► Northeast Airlines hopes to expand its operation through interchange of equipment agreements with other airlines. First to the Civil Aeronautics Board denied Northeast Airlines' petition to discontinue the National-Capitol interchange agreement, Northeast told the Board it would be willing to enter such a pact as its Washington-Nation route if the National-Capitol agreement were dissolved.

► Iberia, Air Lines of Spain, and Sabena feel their Convair Metropolitan 400 flights are having an effect on competitive British European Airways' Viscount flights over European routes. Both airlines are experiencing a marked rise in load factors on the Convair flights after a prolonged and encouraging introductory period of low traffic levels.

► Pan American World Airways' plan for jet investigate operations include strengthening of flight service based on a long-distance test program. Plan call for the usual service of 180 passengers in 10 minutes with another 35 minutes for clean up. The airline has been testing and modifying galley equipment for the jet aircraft cabin as part of the program. Quick-breakfast techniques are being further developed. The airline plans to live up as flight service to an "international hospitality" status and is expanding its biological requirements for inflight personnel. About 75% of its flight service personnel are now in that group.

► Northwest Airlines has been forced to move all four-engine equipment flights from the LaGuardia domestic terminal to the Marine Jet at the New York Airport because of overcrowded conditions in loading areas at the former terminal and lack of gate space. All four-engine flights will continue to operate from the LaGuardia terminal which carries the airline's regional to maintain duplicate ticket counter and passenger-service facilities for its New York operations.



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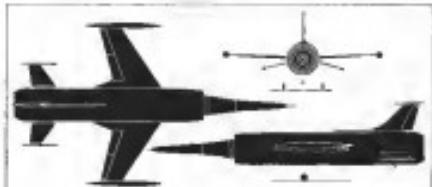
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DIMENSIONS of Leduc O.22 straight monoplane nose flying are overall length, 31.2 ft; height 17 ft; wingspan, 33.8 ft. Approximate total wing area is 215 sq ft.



FIRST free flight of Leduc O.22 took place Aug. 7, 1955. Sea level rate of climb for O.22 was estimated at 60,000 fpm, estimated ceiling was 65,000 ft.

Leduc Ramjet

By David A. Andrusko

ARGENTINIAN, France—Work on the second prototype Leduc O.22 ramjet-powered interceptor, nearing completion and scheduled to fly early next year, faces a Ministry of Defense decision by an intermediate date next summer.

In spite of the importance of the technical contribution made by the relatively small Leduc organization, plans are under way to disband for O.22 along with some other promising prototypes from the lots of government-supported projects (AW Nov. 7, p. 31). This proposed move of the French industry is similar to the British White Paper of last spring, which turned the British Ministry over to the missile business as its chief of itself.

But in view of the ultra-stated French military requirement for no more than 10 years straight to develop whatever the Leduc work should be worth, the second thought is that the second thought may be not bad.

The second prototype O.22 is the seventh in a series of non-carrying ramjet-powered aircraft developed and built by the firm of René Leduc et Fils. It is the fact of the project designed with a military requirement in mind although it is not yet matched to any specific armament system that can it be considered in a part of a weapons system at this stage.

The second prototype is similar to the first O.22, now at the Right Bank of the government test center in Bourges to the south of Paris.

Sophisticated Shape

The Leduc O.22 now flying is a blend of a machine gunpoint in the sleek delta-like appearance of the early experimental aircraft. The long cylindrical fuselage, with nose spike thrust to leeward, dominates the layout. The thin rectangular wings and tail surfaces seem added as afterthoughts.

Overall length is about 37.7 ft. Its height is about 17 ft. The wings span 30 meters, or 33.8 ft., and are mounted on the fuselage midsection. Approximate total wing area is 215 sq ft. Plus flap and aileron are about 25% of the chord. Large fillets at the intersections of the wing trailing edge and the fuselage serve to locate the retractable landing gear. The wings have extremely high aspect ratio which probably double as a means of getting the central air flow and cutting down any tendency of the 5% wing surface to flutter.

Interceptor Project Faces Cancellation

The tail surfaces are also distinguished by tip fairings also probably serving as anti flutter devices. Thrust in the tail surfaces is 50%. The horizontal tail is mounted just below the fuselage midsection with considerable incidence. The vertical is a slab tail and is preceded by a small rectangular keel fairing.

In spite of the absence of jet engines, the Leduc O.22 has a very large engine compartment. Standard front landing gear is used and there is a fourth wheel serving as a tail bumper.

Flying Powerplant

Essentially, the O.22 is a flying powerplant with lifting and control surfaces, a cockpit and landing gear added. At most, only possible design concession has been made to get optimum engine performance.

The engine begins actually at the sharp point of the nose spike that generates the first free stream wave in supersonic flight. The spike continues to expand shock to the 1.8 Mach hypersonic speed the rest of the time. Two completely separate Mach cones. Two-thirds of the air along the spike, there is a violent change for the reader, just forward of the spike is a small annular scoop which is boundary layer bleed.

The tip of that scoop generates a second inclined shock wave which sets the design speed range of the O.22. Fan ingests air as the air moves by and then moves it downstream at speed determined by the cone that is then further to a Mach cone system. At the maximum transonic air deflection of the spike, the control loads, near the throat section, is porous for fine control. The aerosol shock occurs in the diverging portion of the conical section and adiabatic deflection follows.

Mounted in the center of the base line is a single Searle Atar D3 turbojet engine. In this is used for the decelerated portions of the O.22 flight profile—lift-off, landing, cruise and takeoff to gain altitude. Starting at its exhaust nozzle and continuing outward along a radial surface are the nozzles of smaller boosters of the main engine. These have a maximum diameter of approximately 5.4 ft. and the nozzle diameter is 6.6 ft.

The nozzle exhausts through a converging nozzle.

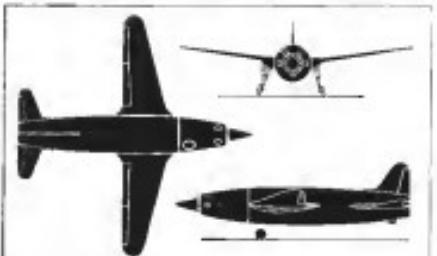
Structural Composition

The structure of the Leduc O.22 is not immediately conspicuous, for

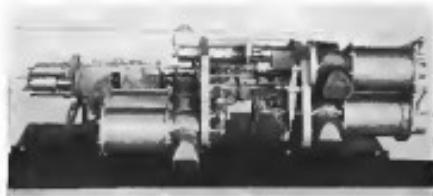
the simple shapes that absent everything to the airplane fail to be capable of being built in the Leduc factory. For this reason, forgings and such small parts, everything on the engine and the ones below it, come out of the Leduc shop. This is probably unique in contemporary air craft design.

Integral Stiffening

Wings of the O.22 are built from stiff ribs and integrally stiffened. The company's new practice has been a fusion of all the Leduc experimental experience including the first O.22, which shows that Leduc has been building integrally stiffened wing skins for a few



ARMAND O.16 was first prototype to be airborne. Flights began in November 1956. First capture as a Langley Swapmeet, later with the O.22 cut off as a glider.



FOKKER control system for the Leduc O-21 (left) was designed, built by Fokker's technical staff.



Accessory package for O-21 at right.

ade, much more longer than most everybody else.

The wings are made an upper and lower halves on a large horizontal La Régale horizontal miller designed according to Leduc's requirements. The miller is being used by Leduc on some subcontract work for other firms in the French industry, the smallest was bought for him by the French Air Ministry.

The fuselage is the pride of the Leduc aircraft which is not yet equipped by U.S. or other French standards. The skipper of the first experimental airplane flew over in the United States during the war. There is a small number of courageous entrepreneurs and risk takers who have been in the business long enough to make up deposits, one part is hard and with elementary tooling, there are specialist machinists who

make the light-aluminum parts for engine control systems, there are metal, welders and assembly-builders and tools are everywhere.

In one corner stands the grace skeleton of the second prototype O-32, just beginning to take recognizable shape. Off diagonally in the other corner is the exploded outer shell of the ram jet engine for the main ship. Note it is a cockpit mockup and a scaled-down model of the airplane that was used to flight-test the engine section.

Wind Tunnel

Across the room through a large, round, ribbed ceiling hangs Leduc's transonic wind tunnel. It's a cold-disk type, discharging from atmospheric inlet to a battery of vacuum ports.

Size of the test section is about 11

in. square; there are flow records blocks for Mach numbers 1.1, 1.75, 2.0 and 3.0.

Three water-driven surface pumps have the capacity to evacuate the vacuum tanks for a ton every half hour.

Test data includes standard force measurements-like drag and pitching moment-plus pressure distributions and infrared absorption or photogages.

I saw a test run on the diffuser inlet at Mach 2.0, flow in the test section

was very uniform and there was no

distortion of spectrum spectrum caused by manufacturing errors in design, manufacture.

The home-built ultrasonic meters produced a solid-ready, high-quality picture.

As with the Leduc airplane, almost every part of the tunnel has been designed and built by the staff, including the balance system, manometer based and the air lenses.

Lengthy Cooper

More than 24 years have separated René Leduc's early studies from the achievement of his current airplane. Starting in the depths of a world-wide depression, his work has sustained a wait, an invasion, an occupation and its puppet government, postwar rearmament and a subsequent altitude that has driven development costs in the aircraft business almost out of sight.

Leduc's first serious proposal for a transonic-powered aircraft was made in 1933, with a basic design almost identical to the first prototype airplane shown earlier. His present airplane is about the same length as in 1934, with the critical analysis supplemented by tests made in a transonic windtun with a free engine. The following year Leduc was able to interests a profitably flight test for the first time in his developmental work, but the conclusion of the program was irregular and prolonged.

Specific studies made by Leduc in 1935 included overall weight analysis, work on combustion and flame calculations,



WINGS of the O-21 are milled down alloy skin and integrally stiffened. The present, quite considerably new, has been used by Leduc for a decade.

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In 1950 he continued his theoretical work, extending his studies in a sonic-speed jet and calculating performance of a series of diffusers in which the contraction varied as a function of a constant mass; the related area times the quantity was termed Mach number squared.

Parallel to these studies he continued his testing.

The first phase of his work ended in June 1954, by which time Leduc had achieved sonic combustion and had completed an official test on the engine submitted by engineers of the French aviation technical service. These tests were made with an engine of 1.2 in. outer diameter and 1.5 in. exit diameter (exit throat Mach number was 3.967). The recorded thrust was 84 lb and the fuel consumption was measured at 2.55 lb/lb. thrust.

Official Recognition

The following year the French Air Ministry gave Leduc the go-ahead to build and test his prototype aircraft, officially approving the language program he had laid out for a series of steps leading to unseated experience flight in a military atmosphere. Leduc was assigned available space in a Breguet plane and moved in.

Series construction and test work on the first prototype, O.10, began in 1958. Construction did not start in the plane until the Breguet laboratory, paralleling the detailed design of fuselage lines. Wings and control surfaces on the drawing boards. A one-fifth scale combustor chamber was built and tested over its expected operating range. Wing profiles of 0.25% and 12.25% were tested tested at Mach numbers of 1.6 and 2.8. Defense trials began again in 1972, seeking a definitive aircraft for the prototype aircraft.

About this time, Leduc and his engineers began another unusual program. They started development of a gas turbine to drive the pump and compressor for the engine and auxiliary. The state of the gas turbine at that time was very sketchy. The Germans had to build and fit an aircraft gas turbine had several months to go before getting into the air. Frank Whittle in England was deep in development work and proud of his design. In Italy, Guglielmo Marconi was working toward a 1948 flight date of a rocketplane, directed by engineer.

That, plus the experience of building large heavy gas turbines for automotive powerplants, was about all Leduc drove into this problem and in 1958 had his gas turbine running and driving accessories.

The one world war freight Leduc with completed engine conducted

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chariot and gas turbines and no particular desire to hand them over to the invading forces. With a few of his staff, Loder took off for Tasmania, taking his unclassified hardware, drawings and technical data with him.

The Nazis had never given away what it had, had the Germans been impressed with the caliber of his work. But post-war interviews with some of the pre-war spectators in Germany showed that they knew of Lenau and his efforts, but considered him crazy and had no signs of motivation.

Work Contexts

Lodge kept after the Vichy government during the occupation and succeeded in getting a green light from them in 1943 to continue work. But his plant was burned in 1944 and most of the plans of the work were destroyed.

"In August that year he started again on the G-10 and completed the complete following test in a form stereophore. Preliminary ground trials took more time so that the engine did not get into the air until 1946. Since its only engine was the engine, which was said, never until 1946 had its engine been matched. Later due to the air break the plane from a framework structure on top of a Langstroth Bee-engaged propeller designed before the war in Marcel Black (now) Denmark and entered into production in 1941 by Vebry for the Germans.

Flight tests began in November 1946, first captive in the Langsdorff and later with the O 107 not all as a glider during a shallow dive of the carrier plane. Many flights proved the suitability of the system and the controllability and flight parameters of the Leda craft.

First night

Then on April 21, 1946, Jean Gossard climbed the ladder from the Languedoc wing to the low, circular cockpit entrance of the Leduc D 10 and squeezed in. The four piston engines of the cluster hallowed, and the composite craft lumbered from its hangar to the tarmac.

At 11,000 ft., Col. Perini, now on the Luray staff, dropped the nose of the Longeodoc below the horizon and began the shallow dive for separation. Gossard in the O-10 tilted to Perini, told him he was zenith so light the engine and cut boost.

Above the Languedoc, the huge motor engine came to life with a roar, its bright yellow flame lancing the reddish surface of the canyon. The roar was steady, the flame sheet, the seared earth.

Pierre and Gérard checked instruments once more, spoke briefly over the radio link between the planes "Alka", the planes separated, the O 10

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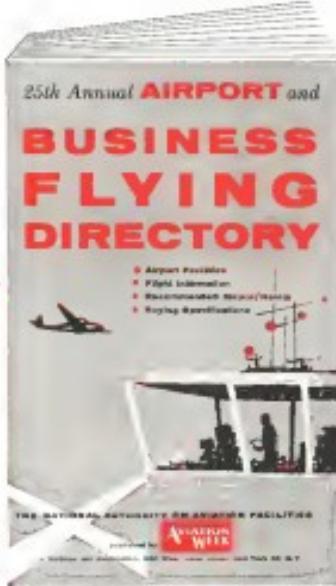
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Soviet Short-Haul Plane
The Li-2 (Liudmila Belikov) was designed by O. K. Antonov for short-haul airline routes (AW Aug. 16, p. 16). Six-passenger, non-engine plane can carry mail, light cargo and persons and/or photography, movie cameras, other loads. Aircraft cruises at 120-140 mph., a range of 600 miles at 10,000 ft. It can land on a small field, and it may open up a 40-48-yr old long. Plane is equipped with instruments for blind flying or night flights. Its relatively high ceiling allows it to penetrate into Russia's passes and fields.

lifted and the Lancaster dropping like a stone.

Gunned pulled up and away to the left, with the engine a steady blare behind him. On that first flight he took it easy, turning on one set of buzzers after another and accelerating to 450 mph. More power later he wheeled the O-10 around with a glide and turned silently to base.

On later flights with the same plane, Gunned reached 36,000 ft, touching Mach 0.84 in the climb at 25,000 ft. His rate-of-climb indicator was still showing 80 meters per second, which converts to just under 7,000 ft/min. Fuel consumption was 3.25 lb./hr. at Mach 0.84.

This was about the maximum performance of the first prototype.

Next Prototype

The first two prototypes of the O-10 originally, which were extremely aerobatic externally and internally, were followed by the Leduc O-16. They were basically the same as the O-10 series, but a pair of Turbomeca Marboré 3 turboprop engines fired at the wings for support of the jets.

These were used during the flight test program, but later abandoned and replaced by Pratt & Whitney. This engine was cleared for flight early in 1952.

Construction of a pair of O-20 prototypes was followed by the O-22. These were larger aircraft, their engine diameters were 4.75 ft. as compared to the 3.5 ft. figure of the O-10. The first prototype, finished at the beginning of 1953, began its captive flight tests in Mar-

ch 1954. The first flight Longendorfer still the engine.

First free flight of the O-21 took place on Aug. 7, 1953. The second prototype O-21 flew under its own power the following March.

After a series of flight tests, Leduc test pilot Jean Lainoff recorded speeds of Mach 0.91 and a maximum altitude of 46,000 ft. The climb performance of the aircraft was outstanding. The sea level rate was estimated at 40,000 fpm, and a measured figure was still altitude at 16,000 ft. It showed the plane to be climbing at 15,200 fpm. Estimated ceiling of the plane was 65,000 ft.

Air Ministry Support

The French Air Ministry has apparently decided to go in what is probably the largest single engine development project in history. Having a brief holiday during the occupation, development funds have continually been forthcoming for the Leduc effort.

T2V, WV-2 Cutbacks

Washington—Lockheed's reduction of 100-400 Lockheed Constellation Corp. employees will result from cutbacks in production of the conventional still shows advantage over a solar-powered aircraft of comparable weight in cost or complexity. The solar angle is later than a conventional aircraft.

These figures add up to one general evaluation: the conventional aircraft is an excellent powerplant for an atmospheric.

Foster's obvious defense need is an atmospheric. Current indications (AW Oct. 7, p. 31) are that the word will be solved first with the Douglas Marine 3

Nobody can deny that it is a long-term project but some observers have questioned whether or not it has been too long a time. They cite the fact that France has now several supersonic flying with Mach 2 potential and that Le Bourget themselves lost the bid to build the Concorde.

The answer to this criticism lies in the major present-day flight. Light air travel, pending continuous threats for war, does not require the kind of performance of a variety of fuels from low-grade oils to costly, otherwise, high-octane propellants, the latter engine furnishes a powerplant of extreme economy.

But even major powerplants, it has to be pointed out, need sufficient fuel to light off. It provides no static thrust cannot be used for takeoff in a conventional manner.

Booster Problem Solved

But continued with interest for a long time, the concept rates as still very feasible and the booster problem is solved. Furthermore, the fuel consumption of the conventional still shows advantage over a solar-powered aircraft of comparable weight in cost or complexity. The solar angle is later than a conventional aircraft.

These figures add up to one general evaluation: the conventional aircraft is an excellent powerplant for an atmospheric.



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Carrier's Bulk Dwarfs Demon

Huge bulk of USS Saratoga (CV-60) dwarfs a McDonnell F4H that has just descended from the deck at the search altitude. Photo was taken during carrier qualification operations over Commencement Bay, Calif.

a de-laminated platen with a pre-grooved anchoring base. It features a large budget with ultra bonding pins to anchor legend rocket to ground.

Next step in the solution could be an advanced Seal Aviation Traclet (AV-1 Oct. 7, p. 27). On the next step could be a compressed Leader Q-27. Or it could be a sonic, although even the most biased proponents of plasma arc welding beg to look off on ultrasonic data of apparently superior

long years ago, the French Air Ministry followed similar research. The latest product is of Lorient origin. The mentioned French has been the result of engineering analysis, not political push-baiting. They see there the possibility of aircraft flight intermissions with climb speeds above Mach 2. After the war in the long-needed song of peace, Lorient's walls are spared of trenching routes. It has survived until today with all its original equipment.

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• Pressed fusing at McDonnell Aircraft Co., St. Louis, Mo., which consists of placing a heated pre-formed blank into one half of a 100,000-lb. loaded rocket. The pressure of the rocket's fire holds the blank and thus applying sufficient pressure to make the insulation. Magnesium and aluminum can be pressed.

Pressure is inversely proportional to wall thickness with insulation walls requiring 40 times as compared to 25 times as in 0.059 in.

Other production techniques discussed at the meeting were chemical tailoring, large fusing processes and dry bonding and high-rate machining.



Material Simplifies Electrical Products

Wentzleben Elastis Corp. has developed a new type of electroresistive magnetic core material which can be magnetized in four directions, fitting electrical equipment designs from the necessity of holding core losses down by from very minute packings with the resultant silicon parts and flux loss across the joints. As the electric magnetization fluctuates, the calcined crystalline core loses up to the same direction. Therefore all these are of very important use.

Civilian Test Pilots Form Flight Council

Civilian test pilots at the Air Force Material Development Center, Holloman Air Force Base, N. M., have formed a test pilots council for the purpose of advancing and improving both flight safety and flight rules. The council is currently supporting a freeze which progress initiated by Gen. L. E. Davis, commander of the missile development center.

Membership includes engineering and experimental test pilots from

Hughes Aircraft Co., Convair, Bell Aircraft Corp., Douglas Aircraft Co., Grumman Aircraft Corp., McDonnell Aircraft Corp., Lockheed Aircraft Corp., North American Rockwell, Inc.

Officers of the test pilots council are John B. Broadhead, Narragansett, chairman; William Middle, Bell, treasurer; Raymond Ellett, McDonnell, treasurer; Robert Kishimoto, Lockheed, vice chairman; Dan Mitchell, Goodyear, assistant secretary, and Roger Oglesby, Lockheed, assistant treasurer.



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Canadians Study ICBM Exit, Re-Entry

Montreal, Canada—In intercontinental ballistic missile exit and re-entry problems, and design details of higher performance reentry vehicles, were among the subjects covered at a joint Canadian Aeronautics Institute and Institute of Aerodynamics Seminar meeting held recently at Montreal, Canada.

High-altitude ICBM performance and development test equipment was described by G. V. Bell, R. B. Johnstone and G. H. Tidy of the Canadian Aeronautical Research and Development Establishment (CARDE). The authors described current methods for ground simulation of ICBM flights, the portion describing their work with the CARDE zero-ballistic-range facility, showing how this could be used for problems such as stage separation during ICBM boost out of the atmosphere.

In the CARDE design a light gas gun using a liquid-hydrogen nozzle and with hydrogen in the working fluid is used to launch 3-m. diameter models into an evacuated ring. A dummy chamber is used to trap the heated hydrogen gas after being accelerated to a speed of 2.8 km. in diameter and 60 m. long. It is instrumented with two-dimensional quartz photodiode stations to measure the trajectory.

Gas Controlled

Gas makes the range can be controlled in pressure, temperature and content.

Although the firing range is readily calibrated, the authors said that observations and monitoring problems are extremely difficult. Moreover, the type of model used by the agency launching loads—Metal or carbon fiber of a few grams can be launched at speeds up to 21,000 ft/sec. (about Mach 30), but heavy models (weighing in the order of a lbs. pound) can only be fired at Mach numbers as high as 10 by using a heavy gas atmosphere such as freon.

Summing up the present lack of fully developed ICBM test methods, the authors concluded that current ICBM zero-ballistic problems will continue to be mainly solved by expensive test firing programs.

Comments suggested by designers of efficient reentry with high specific heat, low frontal area, were offered by two National Advisory Committee for Aeronautics researchers and an engineer from Oxford Taylor, Ltd., Canada. Future hybrids, according to these submitters, may well contain the following:

- Transonic compression

allow entry and stage pressure ratio transition rapidly without sacrificing efficiency or range. The geometry of transonic blading employed by NASA was selected from a family of double cascades, airfoils. The high Mach blading differed from conventional airfoils in that the leading edge of the blade is thin and the position of maximum thickness is shifted toward the trailing edge.

Transonic Approach Used

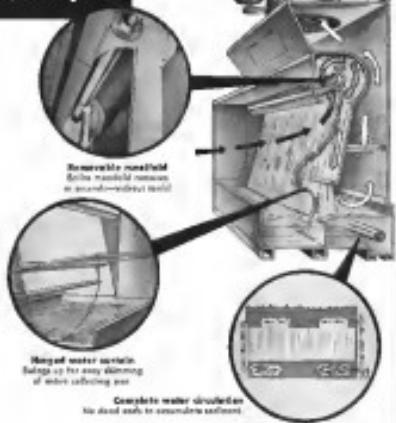
Use of transonic combustion techniques can give a fuel velocity up to 160-400 ft/sec. not predicted for transonic by F. M. Williams, Canada Taylor, Ltd. In mixed-combustion combustion, primary means will overcome obstructions to the airflow, stabilizing



Model of Soviet Satellite

Model of Sputnik displayed in Moscow shows features of Russian satellite's first artificial satellite, which weighs 1843 lbs., measures 23 in. in diameter, is made of aluminum alloy (AW CuL 14, p. 27). Sputnik is reported to have reached peak altitude of 190 mi.

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ation will be done at the rate of 1000 rpm. Manifolds and piping will be made of stainless steel. The engine will be a 1000-hp Pratt & Whitney R-4360. The aircraft will have a maximum weight of 10,000 lb. The aircraft will be built in a few months. The combustion system for these advanced engines will have to be able to operate reliably for 15-20 hr right at the outset of an engine test development program, Williams said. The main focus of the combustion system development will be, not of the question and for this and other reasons the combustion system will have to be ruggedized successfully in the early phases of a new engine.

Turbine Work

Concurrent turbine design techniques, according to Robbins and Pihl of NASA, result in systems performance which is efficient under the high work-output conditions required for supersonic flight.

However, these losses can be minimized by careful attention to the aerodynamic coupling in the turbine nozzle and the turbine can be "scaled" to even higher outputs without efficiency drop.

NASA has redesigned turbine blades to avoid the usual extreme vibration peak over the suction surface when the blade is being overloaded. They have found that with new velocity distribution they have been able to design turbines apparently suitable for driving transonic compressors.

Focke-Wulf Flight Tests

Licence-Built Piaggio P-149

Focke-Wulf Berlin, carrying out first flights of its first Piaggio P-149 built under license.

Central Defense Ministry has ordered a total of 148 of this type from Focke-Wulf to be delivered within the next four years. Price per plane is between \$25,000 and \$25,000.

Piaggio is the first of three foreign planes being built under license for the German Air Force to reach acceptance. The others are the Nordavia and the Douglas Magister.

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NACA Studies Ways to Soften Jet Noise

By J. S. Butz, Jr.

Cleveland, Ohio—There have apparently been no changes in jet noise levels as being investigated by the National Advisory Committee on Aeronautics at the Lewis Flight Propulsion Laboratory here. Considerable weight is being placed on them as difficult solutions have been devised and each noise reduction method has its disadvantages.

The general areas of study are:

- Mechanical suppression (vanes, slots, flaps etc.)
- Engine design
- Cabin pressurization

This NACA work is directed both to decreasing noise during takeoff and climb of aircraft. In the study and evaluation of these operating with various manufacturers and research groups here and abroad.

Main Dragback

Many types of mechanical suppressions have been tried and there may have been little to show that they reduce noise through blade cutting noise. To the extent that this contributes to the noise, this could mean a revenue loss through reduced passenger loads.

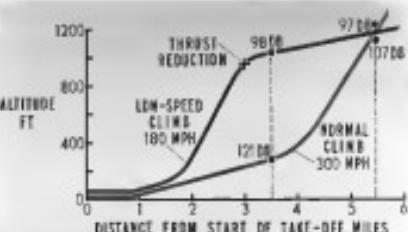
However, the NACA has a sonic boom mitigation that reduces noise to the required level without the necessary thrust losses. The only drawback of this mitigation is that the aircraft will accelerate more drag at the aircraft end of the shock wave.

The whole project is in the experimental stage and efforts are now being made to make the engine both refined and light.

Current study of the nozzle optics has given the NACA considerable hope that a suitable nozzle in this voice section will be selected through a relatively simple mechanical device. Much



CORRUGATED nozzle in combination with corrugated sheet metal optics at nose passing over supersonic flow studied by the NACA. Optics eliminates thrust loss due to the corrugated nozzle, but it has a high drag which would lower aircraft range.



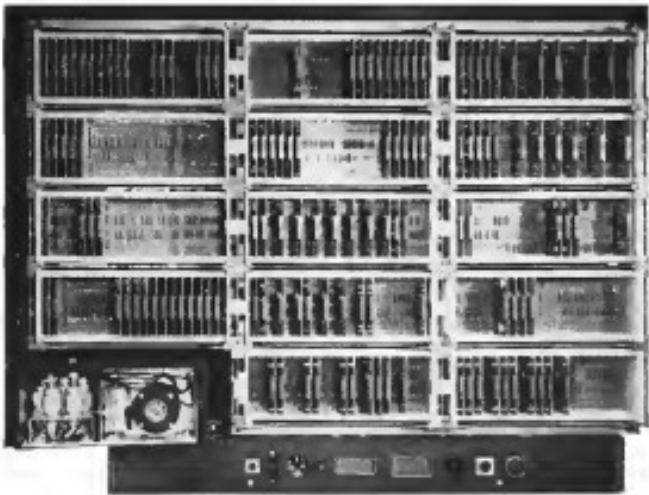
TAKEOFF and climbing performance especially reduced for each aircraft and its surrounding environment can do much to lower jet noise in populated areas. Typical aircraft performance and the noise it creates on the ground for shockblast compared to a proposed low-speed, low-noise climb.



THRUST 1330 ft/lb/sec



JET THRUST noise can be reduced by lowering turbine temperature and exhaust velocity. Using new design techniques, low temperature, low noise engines can equal the power and efficiency of today's high-temperature jets. More efficient high-temperature engines could also be built with the new design methods. Exhaust velocity and noise of jet engines (light) is affected by low energy in jet flow. If the engine has about same power level as the low-temperature engine (above), less



The Role of PRODUCT ENGINEERING in Systems Work

It has become characteristic of modern weapons systems that they are required to operate under severe environmental conditions, as well as to meet stringent weight and space limitations. Moreover, the complexity of many of these systems poses additional difficult reliability problems, while at the same time the increasingly critical consequences that depend on the proper functioning of the typical system logically call for a higher degree of reliability than previously achieved. The same is true of certain electronic systems for industrial applications, such as the Ramo-Wooldridge digital control computers, some of whose design features are shown below.

Moving all of these requirements is a large part the responsibility of product engineering. Generally speaking,

log, produce capacious items with a system or subsystem at the breadboard stage and transforms it into the final product, which in addition to meeting all of the requirements previously stated, must be parasitic to manufacturing and to maintain. Such constant production requires the development of ingenious mechanical design features, a thorough knowledge of circuit design and component reliability, and a broad familiarity with materials and manufacturing processes.

At Ramo-Wooldridge, the product engineer is an essential member of the research and development team which has the full responsibility for creating new systems, from the initial theoretical studies on up to the manufacturing stage. Engineers experienced in product engineering are invited to explore the variety of operations which exist at Ramo-Wooldridge in such fields as airborne aerospace and control systems, communications and navigation systems, digital computers and control systems, and electronic instrumentation and test equipment.

The Ramo-Wooldridge Corporation

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work still remains before this practical device is achieved.

These methods of suppression are designed to alleviate the two conditions as the high velocity exhaust of a jet engine which are the primary causes of its noise. First are the turbulent eddies which are created in the high speed air flow messes with the low speed outside air. These eddies produce fluctuating pressures which induce sound waves.

The second major source of noise is the shear at the edge of the jet blast which results from the steady compression of the exhaust velocity. This velocity shear greatly amplifies the acoustic output of the turbulent eddies in the jet blast.

Suppression Method

Mechanical suppressors will attempt to reduce the intensity of these two noise sources by:

- Increasing downstream spacing of the jet to attenuate the strength of the eddies.
- Increasing contact area of the jet blast with the outside air to reduce velocity shear.

Many nozzle designs have been studied. One is the "open pipe" type which has the nozzle exit end cut through a series of small slots. An air sonic nozzle has deeply flared nozzles or convergences to spread the exhaust. Parallel slots have also been tried on nozzle.

All of these types can produce the required jet noise reduction at 15 degrees to bring a free jet transonic plume directly outward at 30° to 40° to the wind level at a place with full power to the wind level at the same conditions.

They are all faced with the same serious difficulties, however; they tend to lack power on the edges of the plume in extreme velocity crowding a short distance.

Ejector Reduces Loss

The back pressure and throat loss can be eliminated while achieving the required sound reduction by introducing a corrugated nozzle with an ejector, according to the NACA. The engine is then of jet pump. High velocity jet pressure is used passing through the nozzle body to draw air from around the jet blast. This reduced pressure at the jet surface and gave the velocity shear gradual spreading instead of a more gradual change. As mentioned previously, this promising unit is being developed further to decrease its weight and the drag of the plume.

Another basic approach to the noise problem is a change in engine design so that cavitating exhaust velocities could be efficiently reduced. Lowered jet velocities would have added benefits beyond the engine world: ram costs,

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General Specifications

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Total Volume—Less than 9.7 Cu. Ft.
Dimensions in inches of the requirements of MIL-E-1000, MIL-E-1001 and MIL-E-1002.

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VICKERS

As a part of an jet engine hydraulic starting system evaluation program, Vickers Incorporated recently demonstrated the ability of an interim package in twin Century Series fighters. Acceleration to ground idle speed of the F-102A fighter aircraft, installed in a production North American F-100D Super Sabre, was accomplished in times comparable to other known starting systems, using only 50 horsepower prime mover power.

Continuing basically of production Vickers aircraft hydraulics components—performance proven on almost all existing U.S. military and commercial aircraft—the Vickers starting system offers substantial savings in weight, size, and cost—both initial and maintenance—and other advantages. Available as either a gross or modular unit or as a completely installed subassembly, the Vickers starting package is capable of dual function. After normal starting, the hydraulic motor can serve as an engine driven pump for aircraft auxiliary power requirements in the altitude range.

For further information regarding Vickers hydraulic starting systems, write for illustrated brochure 5E91a. Also, your nearest Vickers representative can show you the many system combinations available to meet your specific needs.



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ENGINEERS AND BUILDERS OF GYA HYDRAULIC EQUIPMENT SINCE 1923.



EXPERIMENTAL noise measurement is measured on a test engine at the NACA Lewis Laboratory. Noise drops linearly over frequency but the reverse occurs above.

with longer life and greater safety. Current transport engines which are based on ramjet designs require high takeoff noise reduction, and most—both commercial and military—use two other methods. Available as either a gross or modular unit or as a completely installed subassembly, the Vickers starting package is capable of dual function. After normal starting, the hydraulic motor can serve as an engine driven pump for aircraft auxiliary power requirements in the altitude range.

The alternate procedure which results in low noise for people on the ground is to take off and begin climb straight up at once at an altitude of about 100 ft. This allows a minimum of maximum noise until an altitude of 1,000 ft is reached. Then the plane climbs back in 16% power and brings the nose down to the point that will allow it to accelerate 300 ft speed. At this point on the climb the propeller starts its rotation to reduce the sound on the ground by 25 decibels at a point 35 ft from take off.

It is impossible to reduce any kind of fast roll short how much climb rate is used and noise is in one place. Low noise is obtained with a fast roll, but it is probable that such separate aircraft can do this and can take off rolls to profit reduce the noise in neighboring populated areas.

There is the further possibility of combining all three of these general approaches in the same problem to achieve a single economical solution. Cost, thrust losses and weight are all factors at the greatest importance when considering devices and procedures to be used by commercial aircraft. While effective noise reduction methods may presently available they must undergo development before they will be acceptable to the airlines.

The third method that the NACA is considering for reducing noise is by varying the aircraft flight technique. Chair page 73 shows the usual



PUMP PRIMERS
by
Arthur A. Nichols

Low weight, high performance and small vulnerability to speed and geometry of housing structure make hydraulic pumps ideal for aircraft noise reduction, fuel and scavenging systems.

Engines powered with drives, auxiliary power sources, pressurized oxygen tanks and various transmission units provide a wide variety of applications for these have found Gerotor type pumps extremely useful in their attempts to hold weight down and achieve maximum compactness while maintaining reliability.

Small turbines, drives and their gear assemblies, for example, are using this pump type to advantage in many aircraft applications of importance. The Gerotor pump is a positive displacement type,

driven directly from a shaft at a fixed ratio of 1 to 1. This allows a pump to operate at a fixed speed—simple and compact in basic design, this unit has many parts. It is a direct drive pump giving exceptional performance and has an average long service life. It is balanced and extremely quiet in operation.

Unlike conventional gear pumps, the Gerotor pump is a true positive displacement unit which is relatively compact due to its ability to provide continuous fluid-film lubrication without external bearing supports. Thus the plain bearing bush is 16% power and brings the nose down to the point that will allow it to accelerate 300 ft speed. At this point on the climb the propeller starts its rotation to reduce the sound on the ground by 25 decibels at a point 35 ft from take off.

It is impossible to reduce any kind of fast roll short how much climb rate is used and noise is in one place. Low noise is obtained with a fast roll, but it is probable that such separate aircraft can do this and can take off rolls to profit reduce the noise in neighboring populated areas.

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Fig. 1 Integral transmission pump.

Figure 1 illustrates an integral transmission pump. It is a form of internal gear pump—simple and compact in basic design, this unit has many parts. It is a direct drive pump giving exceptional performance and has an average long service life. It is balanced and extremely quiet in operation.

Unlike conventional gear pumps, the Gerotor pump is a true positive displacement unit which is relatively compact due to its ability to provide continuous fluid-film lubrication without external bearing supports. Thus the plain bearing bush is 16% power and brings the nose down to the point that will allow it to accelerate 300 ft speed. At this point on the climb the propeller starts its rotation to reduce the sound on the ground by 25 decibels at a point 35 ft from take off.

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Figure 2. Multi-stage pump.

geometric. It can be "cubed out" in a number of ways to increase the volume of the pump housing (Fig. 3).

Valveless design, because absence of mechanical seals and wear problems inherent in valve construction.

Tested indications plus complete engineering drawings and precision manufacturing instructions are available to help the designer in the early stages to meet most specifications. Your inquiry is invited.



AH-64 reconnaissance helicopter shown at full 275 hr. altitude at target. Helicopter then drops quickly behind covering trees.

Army Evaluates Armed Helicopter Units

By Robert A. —Experimental units with armed helicopters have at the Army Aviation Center will be reviewed soon to evaluate tactical doctrine and organization requirements for operations from corps areas.

These proposed helicopter units will be self-contained and able to support themselves for three or four days in

the field with their own maintenance, supply and evacuation of battle casualties.

- Their function will be to provide:
- Close reconnaissance over wide areas; seventeen major units in no more than battlefield range.
- A means of rapidly inserting troops into combat.
- A means of rapidly mounting strong patrols, attacks against enemy troop concentrations, supply and maintenance groups that reposition themselves to be forward.

To accomplish this mission, flying troops units will have reconnaissance flights equipped with small teams of helicopters, flying control groups with much larger equipment, support units of large helicopters with their whole parked down to mobile and resupply gas stations and supply and resupply groups of large helicopters.

Patrol Function

Initial patrol procedure of a flying column will be to form a reconnaissance group operating in one of several sectors in a assigned sector. These reconnaissance groups would carry four single elements of two helicopters to several elements functioning together. They would be able to cover most territory more thoroughly in a single morning than mechanized units could in several days (depending on the terrain).

Enemy concentrations too small to warrant an assault or full-scale airborne attack and too distant for engagement by mechanized troops would be attacked by the flying column. Flying patrols would be in a different manner than a line of departure where they would escort the original helicopter. Weapon sections would then provide the helicopter to a leading area close to the enemy concentration.



BELL UH-1 Iroquois helicopter shown with four M60 cal. machine guns approaches a target at high speed under cover of a smoke belt.

An situation for such missiles and machine guns by the weapon section would keep the crews down and suppressed for while crews discharged armaments and withdraw. Usefulness of the weapon and reconnaissance sections would then be available to other weapons for targets beyond the disengaged weapon sections.

Limited Air Area Fire

At the moment only anti-air is possible from helicopters, but it is believed, because it is believed that they will be effective against point targets such as tanks.

Helicopters are able to take advantage of terrain and cover. In wooded and gently rolling country of the type surrounding Ft. Rucker, large groups of helicopters can move rapidly with little possibility of hostile observation from the ground except from very high altitude. They can drop smoke bombs, marker smoke, etc., throw a few feet off the ground or above the trees. Then attack an unlocated target in sudden and devastating. A small number of armed helicopters can seize a large area with effective fire for several minutes.

The helicopter is, of course, vulnerable to sustained weapons fire from the ground. But this will probably only be effective in open flat country with little cover, or if the helicopter is at point blank range. This will probably lead to the development of mobile routes of helicopter approach to stop flying mobile patrols and attack groups before they reach their objectives.

Seizing Role

Function of the mobility unit has at least two to locate the enemy, and this usually results in drawing mobile fire. The unit is the small helicopter will probably not fire any better or any worse than its mechanized and armored predecessors. The helicopter will give him a maneuverable and rapid vehicle for this, as has been demonstrated by Ft. Rucker.

All helicopters in flying column units will have some type of armament for their own defense and for ground attack. The reconnaissance craft will have machine gun and/or rocket installations. Flying column will have detachable machine guns which can be fired in flight and then removed for ground use. They will also have port holes so that individuals in the helicopter will be able to stand or坐着 on the soft ground fire that might be encountered. Reconnaissance and evacuation crews will have mobile equipment.

Helicopters are also being made that another weapon will have to be added to the flying column units. This would be an anti-helicopter weapon with the specific task of protecting



H-21 weapon helicopter flies solo at 1.5 hr. altitude. Complete payload of each weapon ship is devoted to mobile and machine gun armament.



APPROACH is made by Sikorsky H-34 weapon helicopter (above) before attack. A few of them can inflict a target with continuous fire for several minutes.





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other craft in the most and disseminated
velocity from attack by hostile heli-
copters. It is generally believed that the
only flying machine which will be effec-
tive against a helicopter will be another
helicopter.

Gen. Hause's Description

Maj. Gen. Howard H. Hause de-
scribed the agency's study of the feasibility
of aerial vehicles as follows:

In June 1956, when Brig. Gen. J.
Hutton was commander, a small group
of volunteer pilots and enlisted
astronauts were recruited at the Army
Aviation School and aerial stability tests
were begun, using reconnaissance heli-
copters as test beds.

Four functional categories of aircraft
were considered:

- Reconnaissance vehicle (H-13, H-33 class)
- Speed aircraft (H-21, H-34 class)
- Transport vehicle (not clinched)

Follow-on research was studied for
possible applications:

- Armored machine gun—30 and .50 cal
- Various food for aerial soldiers
- Various bridging for aerial rockets
- Reusable radios
- Grenades and chemical bombs

The program was divided into three
phases:

- Feasibility studies and experiments
- Tactical employment tests of prototype
and company-sized units of aerial attack
aircraft
- Operational studies based on first
two phases.

Phase one is, and will be, a continu-
ing series of experiments as different
weapons are tested for the roles indi-
cated.

Some Capabilities Known

Known capabilities are:

- Reconnaissance helicopter—At one or
more machine gun were believed to be
equipped, tests were made to determine
a maximum machine gun capability of
the light helicopter.

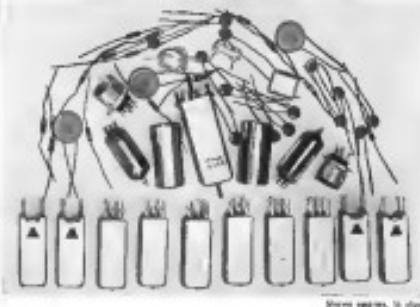
This was determined to be two
AN-M2 .50 cal. serial machine guns
(2000 rpm per gun) and one AN
M2 .30 cal. machine gun (2200 rpm
per gun per gun). Fired in 50 mm
serial, machine gun successfully test
fired from a light helicopter. Able to fire
at least twice as fast as rated rate. All
weapons were fired electrically and ad-
justed with an optical aiming device.

- Speed aircraft (H-21, H-34)—Suppos-
ition for capabilities have determined
that the aircraft can fire two or more fixed
and mobile machine guns (one). It can
carry eight or more fixed or 20 mm
rockets (four). The H-33 can handle
a total .30 cal. machine gun (two)
and the nose wheel. Machine guns
(.50 cal.) can be fired from side doors

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— waste gases. Refills can be had from each port.

- **Wingship (B-19, 1955)**—These ships due to their unusual shape fit easily on the base of aerial rocket. Wings are mounted separately from the aircraft and integrated with the rocket and its launcher. This is about eight in the 5-ton class and up to 500 or more pounds in the 1-ton class.

- **Antitank vehicle (off chassis)**—This study is still being conducted and results are not ready for release.

Some basic characteristics of aerial helicopters have been observed. They are indicated by type:

- **Rommelschiff**—This is a light ship and therefore needs much to the usual amount of weapons. Ship can be carried rapidly by radar pictures taken from the ground or from the air. Recovery and deployment of weapons and striking tactics is essential to compensate for the reduced angle along pitch with different load conditions and speed between the low and V max.

- **Helicopter**—This is also under development. It has a horizontal vibration which results in some wonder on landing gear of about 75 in. (including pitch rate). Perhaps it is limited by added gross weight. Sighting from 3 hours to cruise speed, is not a serious problem.

- **Squad carrier**—This is a large, heavy ship and appears to offer much a more stable firing platform than the mobile platforms used in the past. As its vertical function produces extreme difficulties in recovery from nose down when in formation, both elevation and traverse of weapon is indicated. Tandem rotor configuration appears to offer more stability along the pitch axis.

- **Sighting**—Straight ahead is simple. On forward flight introduces problems due to all aircraft with double gear.

- **Weapon ship**—Stability of the utility class helicopter appears to lie between the armed ship and the reconnaissance ship. Maneuver and deployment of weapons appears to be essential. Recovery of weapons requires support to the deck and must be conducted under the ship to be free from tight corner turns. Target tracking accuracy results are promising.

- **Antitank ship**—All lessons learned from other trials are being applied to this study as experiments continue.

Improvements Anticipated

Improved engineering designs of proposed helicopters will greatly raise the amount and speed capabilities of the helicopters as well as provide a much more rugged and dependable structure.

The increased height of the weapon deck disrupts the rear transmission, so presents an effective means of delaying concentrated response for power or short radius. It is not intended that this weapon replace the lighter loads of the armored vehicle or tank. It is believed, however, that it does have the capability of effectively filling the gap between the tank troops with the armored and the tank self-propelled weapon can be passed into problem.

Statistical testing is set to be conducted to determine the full extent of the helicopter capability as a mobile platform. Much valuable test data will be required to and dependability must be established. It is apparent that the helicopter has a great potential in the highly mobile combat operation as required in any future conflict.

Estimates of this result in future field situations will be helpful in determining the full extent of this potential.



15 Years Makes a Difference

Sikorsky R-4 (illustrated) emerged 15 years ago as the world's first production helicopter. Behind it is a S-56, largest Sikorsky aircraft in production.



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- Fine and smooth with additional features to reduce static contact.

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- Temperature cycling range per MIL-C-266C, Paragraph 4.5.5 increased to 230°F. maximum and -40°F. minimum.

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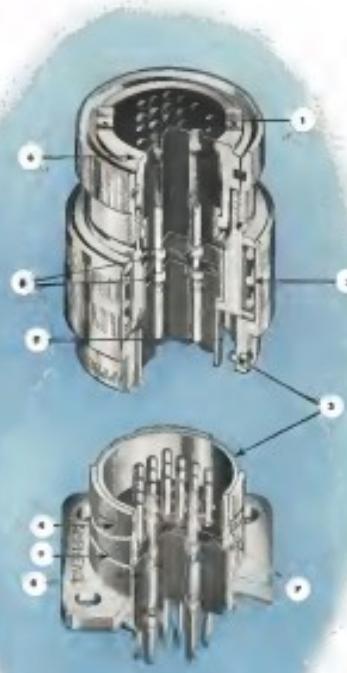
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FIGURE 1 Q-2A drone at midpoint between two 300 ft. towers (one in background) at target range. PARAMEI transponder is in pod.

System Measures Near-Miss Distance

Near miss distances are being evaluated for the Air Force in West Germany under Contract Co with aerospace, Federal Republic of Germany.

PARAMEI is using two methods to measure the distance by which missile misses the target:

- Passive Active Ring Around Radar (PARAR) system
- Wide angle lens camera mounted in F-104F cockpit pod.

Flight tests are scheduled in the near future at Air Force Missile Development Center, Holloman AFB, N.M.

Meanwhile, a series of tests have already been run at Rendsburg Wind Tunnel, Naval Ordnance Test Station, China Lake, Calif., where the Federal Q-2A drone was suspended between

towers at a target for flight. In high velocity aircraft models (F/A-18), the results will assist in calculating results obtained by both the PARAMEI and single camera scoring systems with corresponding distances obtained from camera photographs of known cameras, using range finding for each target.

PARAMEI Systems Utilized

Ralph M. Parsons Co., Pasadena, Calif., is supplying one of the PARAMEI systems to Rentsburg. One system already has been used in the Rendsburg Wind Tunnel, where the remaining four PARAMEI systems will be used at Holloman and China Lake.

PARAMEI systems include target transponders located in F-104F, target

air transponders, and receiving and recording equipment with direct digital readout of missile-target distance versus time.

For Rendsburg Wind Tunnel Parsons modified 10 F/A-18 aircraft without modified external wings and a mounting plate for the missile transponder.

Transponders in the F-104F and rocket pods transmit a signal pulse at a different frequency which is received by and triggers the other transponders thus forming a progression loop. The signal transmitted is measured by a data link and the Federal transponders with frequency shift remove pending the separation of target and missile systems.

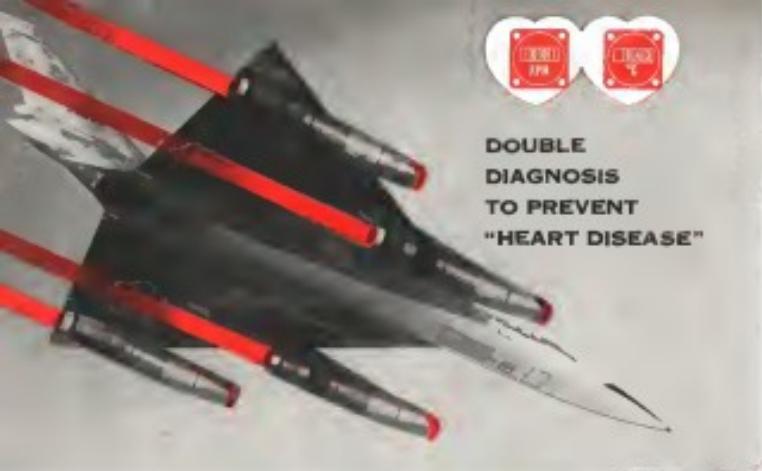
Ranging frequency is modulated by



FIGURE 2 Launch tower for test launch 70 ft. long delta; radar (right) has equipment for missile transponders in place of searchlight.



FIGURE 3 AVIATION WEEK, November 4, 1974



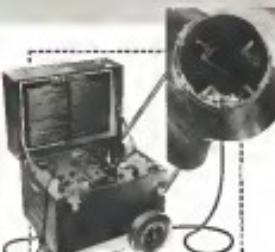
**DOUBLE
DIAGNOSIS
TO PREVENT
"HEART DISEASE"**

...BY THE B&H
JETCAL ANALYZER

Two of the most important factors that affect jet engine life, efficiency, and safe operation are *Airflow/Gas Temperature (EGT)* and *Exhaust Gas Velocity (EGV)*. Errors here will reduce thrust 10% to 20% or more at 50%+ and low temperatures will affect thrust 30% to 40%. Any of these conditions can result in premature failure of the aircraft both costly and dangerous. The JETCAL Analyzer maintains accuracy of the EGT and (uniquely) Tachometer systems and indicates when they start.

The JETCAL ANALYZES JET ENGINES 10 WAYS:

- 1) B&H Jetcal analyzer automatically reads EGT (thermocouple) data of a jet aircraft. It also reads the EGV (Exhaust Gas Velocity) from the engine or atmospheric air when the aircraft is on the ground. Accuracy is $\pm 0.5\%$ at 10°C over the entire range.
- 2) Checks EGT thermocouples while the aircraft is in motion.
- 3) Checks thermocouples while the aircraft is stationary.
- 4) Checks thermocouples and pressure transducers simultaneously.
- 5) Checks pressure of the exhaust gas temperature system.
- 6) Checks pressure of the EGT circuit lines.
- 7) Checks pressure of the EGT circuit lines.
- 8) Checks pressure of the EGT circuit lines.
- 9) Checks pressure of the EGT circuit lines.
- 10) Checks EGT circuit with engine running.



Tests EGT System Accuracy to
 $\pm 0.4^{\circ}\text{C}$ at Test Temperature
(approximately without reading the探頭)

Tests RPM Accuracy to 10 RPM
in 10,000 RPM ($\pm 0.1\%$)

The JETCAL is available now — As the
JETCAL is a portable unit, it can be used
anywhere. Call or write for complete information.

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VALLEY STREAM, L.I., N.Y. • HILLSDALE, N.J. • KANSAS CITY, MO. • 207 Commercial Blvd., NJ 07043 • CONCORD, CAL. • 105 N. Birchtree St., NE 6 HHP

ground station, computer corrects for calibrated base distance to target and attitude transponders, and cross-distance, in fact, is recorded on paper tape together with timing pulses.

Tower Launching

In Randolph, Wash. last, HWAR selected a tower built from top of a 150-ft high hydraulic launching tower which has a slanted tail launcher 70 ft long, and is adjustable both in elevation and azimuth.

Fischer drove the suspended 150-ft steel ground beam into two 300-ft high layers located 2,300 ft downrange from the end of the launcher end.

For additional data on middistance, RWR engineers designed a wingtip pod containing a Tandem 360 camera equipped with a 165 deg. wide-angle lens facing to the horizon.

Cameras was remotely triggered at 40-second intervals and fired from the launching platform. In successive 10-mile range sets, estimates of the nuclear burst height at which Fischer could be exposed.

Three RWR C/781 cameras provided photographic coverage of the tests. Located at various points along route, they collected data on the missile's velocity, acceleration, and trajectory.

Fairchild Orders Up

Fairchild Engine and Avionics Corp., Elmsford, N.Y., and its parent, the \$1,200,000,000-plus for its F-108A aircraft. F-108 technology has increased its total dollar volume of orders for the staff engine to more than \$7,000,000 during the last few months.

Production volume called for by these orders is somewhat over 200 engines. A small portion of the contracts will go to the combined product improvement of the 200 old aircraft which now costs between \$10,000-\$12,000.

Most of the current orders are either for the Navy version of the Riva Two-seat fighter/cruise or strategic Delta aircraft prototypes for USAF Aircrews C-123s.

Aviation Writers have learned that both the 341-powered Navy Fairchild and the Convairfied Aviation 369-powered USAF Fairchild have been running away from the F-107 and F-106 type class planes at 50,000 ft altitude.

At this height, the small plane's lightness, especially after fuel runs low, makes it able to outperform the heavier aircraft.

A Fairchild spokesman said that even though the F-104 is relatively unarmed, it can be converted quickly and inexpensively for drone and target plane applications as expected to carry in production 50c at least another five years.



**critical assemblies
for
critical
operations**

Rockwell Defense Systems Rockwell Defense Systems

Early return flight in about eight minutes maximized safety and the selection of a speed limit sped up flight refueling.

Flight refueling, hot swapping the main engines and nose engines and about seven critical subsystems, were developed by Rockwell Defense Systems and the combination of advanced technologies and visibility. Cost design features of this and improvements in engines and avionics per hour of flight time, which is a key to responsive support and rapid response in support and readiness in full flight conditions.

From subcontracting facilities produce over 500,000 parts a year, including tools — under one roof — with the latest in automation and precision manufacturing machinery available.

You are invited to inspect Rockwell Defense Systems facilities personally — or write to "Rockwell Facilities" which gives the complete picture.

NUCLEAR PRODUCTS



DIVISION, QCF INDUSTRIES, INC.
ANNAPOLIS, MARYLAND

Today SPUTNIK is theirs...

THE MOON is ours!

LAST MONTH RUSSIA SURPRISED, perhaps shocked, the world by launching the first man-made satellite.

This month, however, after odds appraisal of all factors involved, Sputnik means more a victory of propaganda than a triumph of practical science. The moon is still a long way off. We have every intention, and the capability of placing the Stars and Stripes there first.

On the record of the yearns,
In America's proved electronic achievement and
know-how,

In the virtuous of our enormous national resources
—both in manpower and material.

In the firm and far-sighted policy of our government,
In the devotion to duty of the many thousands in
government charged with our national security.
In the very history of our unflinching acceptance of
every challenge,

In the singlemindedness of purpose to achieve our goals
for peace and the welfare of all humanity...

You may feel very confident, indeed, of America's
future.

You can be confident that America already has in its laboratories and testing grounds the means, the men and the machines unequalled anywhere in the world. And we can take pride in the fact that America's achievement in rocketry, avionics and electronic communications is the accomplishment of free men living in a free society.

Yet, what we have, what we have done, is nothing to
what America is in its unbounded reserve capacity can do.
As this spread up of progress accelerates, we will take it
in stride without sacrificing human needs.

The future, like the present, will be in America's control,
which is a very fortunate thing for a free world. It is our
job, and the job of every citizen to keep it that way.

Land Electronics Corporation

Leon Alpert

LEON ALPERT,
President

LORAL ELECTRONICS CORPORATION
NEW YORK 75, NEW YORK

Contributing to America's vital free loss of defense and to its future scientific progress through electronic research and development.

AVIONICS

Plant Choice Keyed to Vibration Level

By Philip J. Klass

Clearwater, Fla.—Now 544 railroad facilities for developing and producing metal products, optics and aerospace, rated "world's most agile plant," has been opened here by Minneapolis-Honeywell on Florida's west coast, near St. Petersburg.

One name of the 25,000 sq. ft. facility is located at 27° 38' N Lat. and 84° 41' 23" E Long, which defines its position to within 10 ft.—accuracy for precision alignment by robotic means of aerial platforms used to test.

One of the major reasons for selecting the Clearwater location over 20 other sites was its relative insulation from natural and man-made vibration—a requirement for testing gyroscopes that have drift rates of the order of 3,800 deg. per hour. Honeywell engineers measured the vibration caused by tides from the Gulf of Mexico, 10 mi. away. They also measured orbital effects—the periodic shifts in earth's crust caused by sun and moon gravitational pull.

Soil Samples

Soil samples were taken down to depths of 10 ft. to test compressive characteristics of sub-slab because foundation slabs in plant floor level are subjected appreciable cover in initial compaction tests.

Honeywell says that vertical vibration in its gymnasium and test area is less than 10 millidegrees of an inch, and it has no floor movements on the scale being tested. Horizontal vibration is only one microinch.

To achieve this degree of isolation the company went to great lengths. The plant is built on pre-stressed concrete pilings, 15-18 ft. deep. To minimize the effect of resonance, the plant floor is constructed 24 ft. above ground level and the building is surrounded by a large moat, enclosing three feet below the ground level. Asphalt spans from building to the road to carry off rain water and the moist air is continuously purged dry.

Groves stand on 10-ft.-thick slabs of concrete and are anchored from under the building. Gyro and stabilized platform are tested on 10-ft. concrete pedestals to isolate them from floor vibrations. All heating, ventilating, lighting, and air conditioning, compressors, and special power generators are mounted on sprung and vibration isolators located at a pre-borne ad-



HONEYWELL'S new Florida facility will develop and build metal systems and components.



FLOATING gyro are fitted with vacuum seal in vacuum enclosure to prevent contamination.



OPTICAL-electrical means are used to align aerial platforms before testing.



To voice the world's newest submersibles

The shipboard and battle-exposing needs of a submarine pose problems that just "standard" equipment can't meet.

Exceptional ruggedness is required, both to withstand shock and to resist heat, humidity, and salt moisture.

Power must be adequate, yet compressed into the smallest possible space.

Dependability is relative to such factors as cruise distances never before attempted by under-water craft.

An example of products meeting such prob-

lems is found in the communications equipment aboard the atomic-powered Nautilus and Bowditch, built by our aerospace division, Electric Boat, and "voiced" by Stromberg-Carlson. Here specified components were so designed to the special conditions involved on the Nautilus, to date, our equipment has logged more than 63,000 nautical miles without difficulty or layover.

Similar equipment also serves the land and air arms of our country's military forces and gives evidence of equal dependability under the special conditions for which they were designed.



STROMBERG-CARLSON
A DIVISION OF GENERAL DYNAMICS CORPORATION
General Offices and Plants at Rochester, N.Y.—Plant Divisions at St. Paul and Los Angeles, Calif.



Cryogenic Gyroscopes

Montgomery Ward, like several other companies, is investigating feasibility of leading gyroscopes that employ spinning electrons in semiconductors to measure temperature instead of conventional spinning flywheels, according to a company official. Progress is in the research stage.

Inside the plant, Phenolic steel girders are reinforced in concrete to provide further vibration damping.

Current Programs

Existing plant is presently an engineering and pilot production facility which can turn out about 50 inertial gyro units per year. Plans are made for a 100,000 deg/sec. manufacturing facility addition. This second level may be planned according to Melvin P. Feldman, vice president and general manager of the new operation.

Current programs at the new plant total about 55 units, including development of "a new type of inertial guidance system," for Air Force's Wright Air Development Center under a \$1.8 million contract. Electrodyne also is building a three-gyro integrated stabilized platform and associated attitude programming unit for the Thor missile. The ballast module, which apparently also is similar to the one the two prototypes developed for Project Vanguard, will be available.

However, also is developing digital computers here with company funds for use in inertial systems. Digital computers are expected to reflect size,

weight and improve computational accuracy over existing computer presently used by Electrodyne.

Current employment here is around 450 of whom about 200 are professional engineers. Total capital investment is reported to reach \$600,000 at end of the year with an annual payroll of about \$5.5 million.

Honeywell reports that it has made significant gains in both the accuracy and stability of integrating (HIG) gyro units from the construction of the firm's inertial systems work. Company officials say that the new facility is producing HIG gyro units with drift rates in the order of 0.001 deg per hour.

This is roughly 100 times better than the early HIG gyro, and approach 1,000 times the accuracy of early production gyro.

Honeywell's Minneapolis facility will continue to make low-cost HIG gyro units with moderate drift rates for use in fire control systems, while inertial quality gyro will be developed and built here in Phoenix.

Another indication of great progress was the report of significant reduction in the number of parts used in HIG gyro units. Honeywell's first mass-produced HIG gyro was constructed with 413 individual parts, whereas its latest model, the Thor missile ballast module, has a subsequent HIG-2 model, the number of parts was cut to only 225. One of the current inertial-quality HIGs now under design has only 90 parts.

Anderson also reported that company's new HIG (inertial integrating gyro), originally expected to have a drift rate of 1.5 deg./hour at a stabilizing drift rate of only 2.1 deg./hour, equal to the accuracy of the much larger HIG-2, now HIG-3 gyro is used in Army's Sergeant missile, Anderson said.

But these gains in gyro accuracy have reached the point, Anderson said, where gyro designers must now concern themselves with the oscillatory nature and internal damping of molecules of the materials from which gyro units are fabricated.

Effect of Errors

Critical effect of small gyro, acceleration and deceleration errors on overall navigation accuracy of an inertial system was pointed out by George Radke, head of systems engineering here. If a Selected-magnet rotation, such as a March 3 response to it to have an accumulated error of no more than one nautical mile after one hour's operation, individual elements of the system must meet the following requirements:

- Gyro drift rate must be less than 0.005 deg./hr.
- Accelerometer error in measuring



OptiTherm® Infrared Radiation Sources

Temperature controlled black bodies

Infrared sources are typical of the infrared line-up. OptiTherm components include those from Barnes Electronics. Glowering OptiTherm sources are universally recognized as precise black body standards for testing and calibrating infrared detectors, spectrometers, and filters. They are also the calibration reference for the NBSR INFRONIC programs as made by Barnes Engineering.

You will find line models of OptiTherm sources in reference bands, with temperature regulation ranges up to 40°C. Four reference bands with 5° cavity spacings are available, and one model for field use has a 15° x 15° reference surface. All models are compact, yet rugged, and are easily mounted and readily interfaced with other components in infrared systems.

Advances in radiation and infrared temperature measurement are linked to developments that originated with the infrared Division at Barnes. These advances have been incorporated and developed to develop unique infrared systems.

If you are looking for unique infrared, refer to Barnes OptiTherm as the supplier of Barnes OptiTherm infrared surfaces, lenses, detectors, and components.



BARNES ENGINEERING COMPANY
Stamford, Connecticut

Are you on the mailing list for TECHNIPROPS? This publication, devoted to development in infrared detection, will be sent to you.



THE NEW GENISCO

ANGULAR OSCILLATING TABLE

Generates a precise sinusoidal motion in accordance with relation Q/S, at accelerations up to $\pm 9^{\circ}$, ± 0.05 up to $\pm 90^{\circ}$, and $\pm 1\%$ up to $\pm 60^{\circ}$.

The newest Genisco machine offers a unique closed-circuit mechanism to generate a precise sinusoidal motion in accordance with the following equation. A precision sine-wave oscillator coupled to the crankshaft can be used to help a test instrument output signal and the oscillating table output signal to coincide for direct reading of phase lag angle.

The extreme accuracy of the Model 8160 Oscillating Table makes it particularly suited for evaluating the damping and response characteristics of angular servo mechanisms, rate gyroscopes, and other components which require high peak-to-peak velocities and peak accelerations in the vicinity of the known angular measure and frequency. Within its range the machine can doubtless be an accurate angular shaker table.

For complete information and performance specifications, write to—

General Specifications

Angular motion: Uniformly oscillatory
Amplitude: $\pm 9^{\circ}$
Damping ratio: Continuously by 0.05 to 1.00 in 2110 discrete steps.
Frequency: 0.05 to 1.00 Hz

Notes:

Angular frequency: within 10% of the specified value.
Angular motion: uniform, continuous, with no resonance, minimum 0.05 with intermediate damping ratios; the maximum 200% with intermediate damping ratios; the maximum 100% with intermediate damping ratios.

Peak-to-peak velocity: $\pm 10^{\circ}/sec$ at any frequency; constant displacement: ± 0.05 sec at any frequency.
Peak-to-peak acceleration: ± 0.05 sec at any frequency.
Maximum load capacity: 1000 lb.

Genisco
ANGULAR OSCILLATING TABLE

2000 FERNDALE AVENUE, LOS ANGELES 44, CALIFORNIA

acceleration must be less than 0.00015 g .

This is the equivalent of an acceleration in earth at which would require an automobile accelerating at this rate from a stand still a total of 75 hours to reach 30 mph., Studies and

- Acceleration required must be greater at start of motion, must be less than 0.04 g. This is equivalent to one second displacement of 100 ft.
- Peak Integrating error (hertz) must be less than 0.015%

Characteristics

Assembly of gears and other metal components is carried out in flexible dust-free rooms, with an emphasis placed on the state of fluids which itself provides a relatively dust-free environment. Besides tools, the means of cleaning and electrostatic precipitation, the dust count on the gear room is maintained at less than 11,000 particles per cubic foot at larger particle sizes. The dust count often is down to 5,000 per cubic foot. Facilities are

Expansions, Changes In Avionics Industry

Fairchild, San Christopher Corp., Palo Alto, Calif., is one of new firms engaged in Fairchild Camera & Instrument Corp.'s second round of corporate research and development at Beckman Instruments' Mechanics Seminar, director Education.

New company, shock wall developed and produces semiconductor devices, is located by H. E. Hale, vice president of Fairchild Controls Corp. Dr. Robert Novak heads new company's research group.

Other recently announced expansions, changes and mergers in the avionics field include:

• Transocean Aircraft Corp., Goshen, Tenn., has completed \$15 million research laboratory for testing performance of avionics systems.

• Bausch, Allen Applied Research, Inc., is now name of the former Applied Research Inc. Company's new address is 410 Green Bay Road, Kenosha, Wis.

• General Electric's Computer Dept., Phoenix, Ariz., has opened a new Computer Applications Laboratory, staffed by more than 70 specialists, to handle business, scientific, engineering problems for rapidly growing U.S. High-Tech industry.

• Sperry Gyroscope Co. has opened new Boston office in Boston, in Myles Standish Plaza, which will be used to represent sales of company's Astronomical Equipment, Air Armament, Microwave

Edgewater rings



or welded



Uniform, dependable, necessarily made Edgewater Rings are furnished in a wide variety of cross-section shapes, and in diameters from 5 to 15 inches. They meet the most critical specification and standards of quality.

Representative applications include bearing races, jet engine parts, parts for starters and rockets, gears, grinding rings.

Edgewater Steel Company

P. O. Box 478 • PITTSBURGH 30, PENNA.





World's First Unmanned 'Copter

The successful maiden flight of Kaman's piloted helicopter has opened a new concept in military strategy. Flown entirely by remote control, the variety of missions possible with these ships is almost limitless. Using the Kaman robot as a flying TV or motion picture camera, complete battlefield surveillance and target marking are available without hazard to personnel. Also possible is the entry of the robot helicopter into contaminated or hazardous areas.

The control station is portable and can be operated from the ground or in an air-to-air operation. Various equipment such as cameras, weapons, target markers and detectors can be selected at the control station.

Kaman is proud of this forward step which has been taken in behalf of our National Defense effort.

KAMAN

THE KAMAN AIRCRAFT CORPORATION
Brimfield, Massachusetts



20 Amps At 200°C

Minature silicon rectifiers rated 20 amps at 200°C, with peak one-cycle surge rating of 360 amps, maximum leakage current of 5 nA, are now in production at General Electric Co., New Semiconductor Division, Pittsfield, Mass. N. E. New rectifiers come in three types: IN1865, IN1866, IN1867 and IN1868, with peak inverse voltage ratings of 90, 150, 250 and 360 volts, respectively.

Electronics and Electronics Tube
Division

* **Gulton Industries, Inc., Metuchen, N. J.**, has acquired Timex Electric Corp. of Canada Ltd., Georgetown, Ontario, through stock exchange. New corporation will produce electronic instruments and components of present capacity.

* **Laboratory for Electronics, Boston**, has formed new Computer Projects Division to develop and market data processing devices. New division was formed from personnel previously engaged in developing data processing systems for both use after compute decimal in addition to the complete data processing system field.

**1955
FILTER CENTER
SALES**

* **Scheneckutter Double-Switch-Bell Telephone Laboratories** has developed, but not yet officials unveiled, new acousto-conductive equivalent of the bone switching tube which makes it possible to construct 30 stage matching counter in a device about 1 in. long. Lead path extensions of 10 mm may be possible from side ports.

* **Micro-Miniature Magnets**-Prima-magnetic magnets as small as diameter as a human hair have been made from Canada (60% copper, 20% nickel and 20% iron) at National Bureau of Standards. Material has an all interesting properties. It can be cold drawn instead of requiring casting or sintering into desired shapes. Cores can be cold worked to point where its magnetic properties are altered. Above normal magnet inspection can be effected by simple heat treatment, Bureau of Standards says.

* **Major Gun** as Telemech-Watch for Radiation, Inc., to reveal a new

PM/FM telemetry receiver design technique which reportedly will provide at least a 10 db gain over existing receivers without modification of the laser transmitter.

* **Turman Side Coupling Clamps**-Semiconductor manufacturers add 15.6 million transistors during first eight months of 1957, more than double the 6.8 million sold in the same period a year ago. Dollar volume was \$17.7 million compared to \$1.7 million last year. The increase is attributed to Elmetra Industries, Inc., formerly Radio Electronic Telephone Manufacturers Assn. (RETMA).

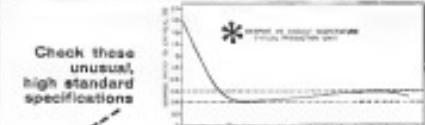
* **New Lightbright No/Cross Package**-Last year will reveal a new, light-weight integrated acousto-mechanical package for business aircraft. Basic version, weighing about 21 lb., will include VHF receiver, transmitter and receiver no-glide provisions. More complete package, weighing about 37 lb., will include the following plus marker beacon, glide slope receiver and automatic direction finder.

* **Magnetics, Anyment**-The 1858 No Cross System, based on Magnetic Theory & Technology has been selected for Mar 57 at Stanford University. Prospective outlets should submit 100

The SUBMINIATURE PRECISION RATE GYRO With Constant Damping Over A Wide Temperature Range*



NO HEATERS
REQUIRED!



Check these unusual,
high standard
specifications

1. Constant damping 100-200°/second from -50° F. to +120° F.
2. Subminiature size (2.07 dia. x 2.0" long)
3. Outstanding reliability (exceeds requirements of MIL-R-5574A spec.)
4. High resolution
5. Extremely high natural frequencies (up to 40 cps for 100° F. lower if required)
6. Variety of center characteristics available (20, 50, 100, 150, 200, 300, 400 cps)
7. Wide range of sensing ranges (from 0.5 radians/sec. up to 20 radians/sec. full scale)
8. Light weight (2.1 oz.)

DETROIT CONTROLS

Division of AMERICAN-STANDED
100 Morse Street, Norwood, Massachusetts



wand absent and 500-word summary of paper before Jan. 15 to Dr. Roy Tennenbaum, 401 California Ave., Palo Alto, Calif.

► **Electronica With French Aircraft**—France may soon export to the United States its manufacture of electronic data processing machines, as, according to publications *French Aviation*, France exports more than \$3 million annually, publication reports.

► **Signal in Detrola Line-Searc**—Searc Systems manufacturer report following an unusual.

► **Cubic Cup**, San Diego, has received \$1.1 million Air Force contract rates for production and installation of its laser system for missile tracking and ranging.

► **Technical Research Group, Inc.**, New York City, reports a \$350,000 Signal Corps contract for study and design of an atomic clock which will be ruggedly rugged in operate in a missile and withstand launching shock.

► **Electronic Communications, Inc.**, Stamford, Conn.; Associated St. Petersburg, Fla., has received \$1.2 million contract from Hughes Aircraft for airborne communications and data link equipment to be used in Hughes fire control systems for the F-102 and F-106.

► **Topp Manufacturing Co., Los Angeles**, has received \$2.5 million contract from Cal. Air Materiel Administration for 65 electronic transmitters.

► **Private VGR-Cod. Avionics**—All contractors has established repair centers for intelligence, surveillance and maintenance of possibly several thousand very high frequency omnidirectional radio range (VDFRs) in CAA Technical Standard Order N-27. Purpose of N-27 is to obtain standardization of VDFRs such as are operated by state aviation organizations with those installed, operated and maintained by the CAA.

► **Wheels to South Africa—South African Vickers Varsity transports of South African Airways will be equipped with airborne weather radar systems to be delivered by British Aviation before the end of the year.**

► **Amy Muscle Components**—Army recently disclosed that General Electric's Missile and Guidance Systems Department has been working on strong and strong materials for Amy, Amak, Amak-House Jolts, Little Jolts, Copper and Lurene surface-to-surface missiles and the Nike-Hercules surface-to-air missile.



Kenyon & Eckhardt's prototype CRT tube, one among many developed transparent phosphor (above) and the other conventional transmission phosphor (below) are key elements in new Army-Navy cockpit display undergoing flight tests in T-33A (AW Oct. 21, p. 34).

Flat, Transparent Cathode Ray Tube Tested in Army-Navy Cockpit Display



Transparent flat tube permits pilot to view through it for combat flight. Development of flat tube was first awarded by Aviation Week three years ago (Sept. 26, 1956, p. 36).



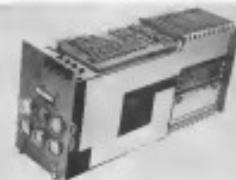
Revised panel of combat flight is presented on transparent flat tube mounted behind windshield of T-33. Lightweight digital computer, developed by Litton Industries, and an analog generator, developed by Delco-Remy, provide signals which create present projection on flat tube intended to simulate what pilot would see under combat (NATO flight conditions). In ultimate version . . .



Conventional instrument panel is now replaced by the T-33-L using latest of unconventional aircraft instruments, panels up, previously completely of proposed new Army-Navy display. New instrumentation has been disseminated to nation's airlines.



Flat tubes will be used both for revised and horizontal situation displays as shown at switch top. Small flight control "stick" is operated by right hand, new type throttle control is reported to be left hand. Douglas Aircraft Co. prime contractor on the program, designed the layout for future aircraft applications. Availability of cockpit instrumentation is limited currently to . . .



Digital metal computer (above) and magnetic charge drain (left) will perform all required computations of flight and navigation data, eliminating analog type computers now employed. Model shown are interim components to be replaced by improved models.

EQUIPMENT

Silwhite Flexible Shafts Make Operations Easier!

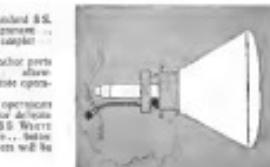


The manufacturer of this bar coated for a color TV set was a standard S.S. White FLEXIBLE SHAFT to cope with a 50° bend. The shaft passes over aluminum ... and the tube is held in place by a strap. Costs are lowered ... manufacturing is simplified ... operations are easier, faster.

You can often reduce a complex system of piping, valves and other parts to one Pneumatic Silwhite Flexible shaft's who make better designs possible ... allowing more space in locating connecting members to save space and facilitate operation and servicing.

For many years, these versatile shafts have been solving industrial operations easier. They are simple and rugged ... yet have the sensitivity you need for delicate adjustments. Disc, solenoid, and motorized actuators are available for S.S. White Flexible shafts even today. Can your problem be simplified by a color TV set?

Is it a simple way of transmitting power or current control? Our engineers will be glad to work out a flexible shaft application with you. Just write to:



SILWHITE
FLEXIBLE SHAFTS



SILWHITE
DATA on how to select
and apply flexible shafts. Write for Bulletin 400.

S.S. White Industrial Division, Diesel AM-10 East 40th St., New York 16, N.Y.; Waukesha, Wis.; 1939 Main Pkwy Blvd., Los Angeles 16, Calif.

New Turbojet Test Cell Can Be Airlifted

Ottawa, Ont.—Completely portable test-cell units have been designed to accommodate turbine engines up to 35,000 lb-thrust capacity. Systems were demonstrated successfully in June with a J75 propellant in a group of about 25 military organizations from Air Materiel Command, Wright Air Development Center, Oklahoma City, Air Materiel Area, Tinker; Air Commando Strategic Air Command.

In addition to a two-man team of individuals from each organization, each of three test-cell units, consisting of 179 cu. ftols and weighs light-towed, total weight 3 hr. 55 min. for an arm and two rags each.

Developed jointly by General Electric Co.'s Production Engineering Dept., Dendale, O., and aerospace Aircraft Apparatus Service Shop, Ontario, Ont., the new portable field test facility includes:

- Engine shafts;
- Control valves;
- Fuel tanks.

Designed for Airlifting

Total weight of the three units is less than 15,000 lb. Each is designed to be completely portable in air, and can be moved on land at 35 mph to meet base mobility requirements.

General Electric is the first built only one prototype portable test-cell system, which was used in the military demonstration, and is also scheduled for use by General Electric in its own programs in its activities at Dallas, Tex., as support of the Air Force Convair B-58 bomber program.

No pressurized gas has been on the portable test-cell system, but it is believed to be in the neighborhood of \$30,000. High degree of commercially available items have been used by General Electric in construction of the test-cell system.

70-Day Development

General Electric says that only 70 days passed from the first test-cell design to the first flight of the test-cell unit without initial developmental discontinuities.

While prepared to mount Air Force requirements for a portable test cell, General Electric specifically selected the prototype system for its J75 engine. But the engine and the system can be modified with adaptors and instrument changes to handle any jet engine in existence or currently proposed, says the designer's justification at \$50,000 for them.



PORTABLE test-cell system is set up for a check of J75 engine. Note how test-cell body is restrained by four earth screws which extend about 5 ft. into soil.



CONTROL trailer has storage area forward, cockpit section in middle giving easy access to instruments. Operator's window is one solid instrument panel.

Systems also has potential in the commercial market market relatively inexpensive engine test facilities are required, for example, at oceanic or temporary bases or for use during transitions to permanent fixed cells for jet transport engines.

Anchored to Ground

Restraints needed for the engine body consists of four earth screws to begin by restraining the bolts on a test base for field testing. Each major engine has a 23,000-lb shear test capacity. Two rear stages are connected to the two front stages by steel beams. Front eng-

ines are tied to the rear of the engine test cells.

Engines which are not anchorably situated in their cells' chassis must run on ground.

Major restraint is furnished through safety restraints attached through shims to the thrust bearing housing.

Major impacts with strict parameter is placed on the ground under end for wear of the engine after to prevent break up of loose earth in other debris. Dolly also can be adapted to concrete pads by fastening out of its base forest to anchors.

Minor tongue and with wheels in

THREE-AXIS FLIGHT SIMULATOR

Providing a flight table which can be continuously oriented in space with respect to three such ortho-parallel reference axes, the CII Dynamic Flight Simulator can be programmed directly from the output of a computer. Operating smoothly with no jerking, the instrument accepts independent voltage signals from all of the axes and

corrects these vector analogs into positions corresponding to the defined pitch rates.

By thus representing the conditions of an actual high-performance aircraft in flight, the unit expands the capabilities of any laboratory.

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weight, dials 9 ft wide, 172 in long and 108 in high.

Control trailer has forward storage section to accommodate adoption, bell tower, debris screen, noise barrier, concrete walls, bermuda and other mass. trailer is designed for 1000 ft power line (gas turbine) or directly fed propane gas system standard 320 ftw, 3 phase low power.

Trailer's control section, about 5 x 6 ft, accommodates test operator and supervisor, contains manual and auxiliary control panels, fire blanket extinguisher and first aid kit. Handrails drop the animal level in the berms to about 50 ft during 177 zone.

General Electric based instrumentation places in the trailer on the importance of fire operation, each having about 10 years of test cell operation. Model 1000 is a standard standard gas generator system. On the right is a lead panel, and on left a panel for various exhaust gas temperatures and exhaust rpm. Instrumentation is standard to make calibrating simple, and is within 1% or better accuracy. All pressure sensing is acoustic and digital. If main power is interrupted to control trailer, fuel flow is automatically shut off, remaining closed until the switch is thrown. No fuel passes through the control trailer.

Designed for Comfort

Today's temperature-controlled, low-vibration trailers. Except for cable lead-in box, trailer is normally closed to test zone level. Access is easily secured through panels on either side.

Control trailer is 93 in. wide, 214 in. long 123 in. high.

Fuel trailer has 2,000-gal capacity provides maximum flow of 55,000 lb per hr at 60 psi, has 3 meters filter tower, as well every 12,000 lb load at 25 rpm.

All trailers are explosion proof. In addition, pressure vessels for the various functions, high-speed thermal shear valve, plus nitrogen inertial valve. The trailer leading a lot to promote portability through mud, snow or sand. Trailer is 35 in. wide, 179 in. long and 87 in. high.

During test runs, distance between dolly, control trailer and tank is 40 ft.

Pan American Jet Seats Emphasize Safety Angle

All seats for Pan American World Airways Boeing 707 jet transports, both first class and economy, will be provided by Pan American Corp. Commercial and special design engineers will be placed on strict liaison in accordance with recommendations made by the National Advisory Committee for Aeronautics.

AIRPORT WEEK, November 4, 1967

REPORT FROM RYAN

Ryan's Diversification Creates Wide Opportunity for Engineers



More Orders for Ryan Firebees

Six B-57s—Navy's 220 mission sorties of Ryan Firebees at close-quarters have been ordered by the Air Force and Navy in 1968. In operational use, the Firebee is the service's most reliable "enemy" target for evaluating the performance of air-to-air and ground-to-air missiles. It possesses the high speed, altitude, maneuverability and extended duration needed to simulate "enemy" aircraft problems.

AirForce's number one jet drove the Firebee to another example of Ryan's ability to meet unique engineering problems. The Firebee's unique aircraft was developed to meet military need.

X-13 Vertijet Adds New Punch to Airpower

Washington—Unveiled as an unprecedented flight of the Peacock, the Ryan X-13 Vertijet gave military officials a glimpse of the future of airpower. Like a large bat, the Vertijet unloaded itself from the nose cabin, burst vertically, then whipped over into horizontal flight and soared out of sight.

World's first jet VTOL aircraft, the Vertijet is the first aircraft to achieve a state of jet power with the mobility of missile launching. It flies supersonic supersonic cruise and ground velocity indicators. Lockheed, simplest, most reliable, most compact of their type, the X-13 cannot measure less weightless performance in speed and climb.

In the words of a top Air Force General, "The Vertijet has provided military planners with a new capability for aircraft of the future."

Arrived in close cooperation with the Air Force and Navy, the Vertijet is based upon Ryan's unengined 215

million program of research, development, and test in VTOL aircraft.

Navy, Army to Use New Ryan Navigator

San Diego—Navy aircraft piston engine aircraft and helicopters will soon be equipped with Ryan lightweight remote navigation and ground velocity indicators. Lockheed, simplest, most reliable, most compact of their type, these systems are self contained and based on omnidirectional radio waves.

The navigator provides pilots with required data such as latitude, longitude, ground speed and track, drift angle, wind speed and direction, ground miles covered and course and distance to destination. Ryan is also developing guidance systems for supersonic missiles.

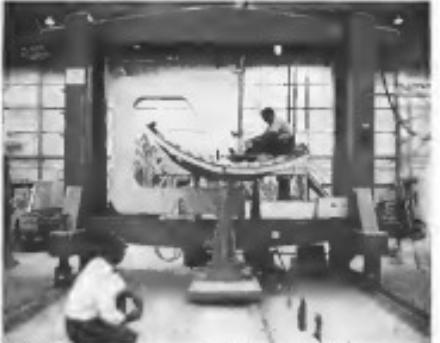
Ryan has immediate career opportunities for engineers

Look to the future land to Ryan... where you can grow with an aggressive research leading change. Where you can work with the best people in the field... where you can contribute to the development of the most advanced aircraft systems in the world.

Mr. James K. Keim, Employment Personnel Manager, P.O. Box 12000, San Diego, Calif. 92137. Send resume.

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POWER PLANTS	POWER PLANTS
DATA PROCESSING	DATA PROCESSING

2000+ open positions nationwide



THREE-POINT riveting arm keeps riveted panel (above) properly positioned.



GANTRY moves around panel, riveting the panel and driving down rivet material.

Mobile Unit Speeds DC-8 Riveting

Nine gravis riveter spending production on Douglas DC-8 planes is currently a huge mobile unit in which sole riveting, riveting equipment, fixturing, work station, and all the need for extra floor space to accommodate panel placement under a stationary riveting fixture, Douglas maintains.

Known as Micro-Cripes system, principal feature of the machine is that it brings the riveting operation to the work, instead of moving work.

In a stationary riveting location, Douglas posts out fixed-level height dual rivet work station, in the need for extra floor space to accommodate panel placement under a stationary riveting fixture, Douglas maintains.

Only space required is flat the length of the part.

Work containing the riveting and three rivets is easily hand positioned over

riveting fixture. Immediate riveting area of the fixture is automatically swiveled 90 deg to the line of riveting needed by a strong actuator.

Automatic cycle starts with bottom cylinder containing a pressure foot moving to the work, starting a cleat base to square panel upward against rivet head.

Riveting action is carried out by two rivet guns acting met apart until they meet. This is followed by the riveting mechanism that removes excess rivet metal to close the rivet. After rivet removal, yoke is hand positioned to hold rivet fixture and rivet is set.

Riveting spans were carried out by T. S. Gandy, tooling supervisor of Douglas Santa Monica Division. Machine was manufactured under license by Almetz Mfg. Co., Bradford, II.

Five of the fixtures are in operation at Douglas aircraft's Long Beach Division.

W. Germans Negotiate Powerplant Licenses

Berni BMW Flugmotoren (Munich) is negotiating with the Federal Republic of Germany for licensing aircraft engines, another agreement with Gneida Engines Co. for advancing the M5.5 and M6.6 of the German Air Force, and a cooperation agreement with Rolls-Royce as joint technical development of some undesignated projects which the German Defense Ministry is expected to order in the near future.

Ultrasonic Detector Finds Metal Defects

Ultrasonic inspection equipment to detect flaws in metal plate, fiber-glass layups, rolled and extruded bars and other shapes of titanium aluminum and steel has been developed by Republic Avionics Corp.

Instrument consists of an ultrasonic immersion tank with mechanized search and purchased equipment, electronic flaw detection equipment and a bridge crane for structural handling.

High frequency pulses are introduced on transducers whether there are defects in the metal being inspected, and the location and extent of any flaws.

Equipment features an alarm system which warns the operator by flashing light or ringing bell when a defect has been located. Electronic machine transmits waves at frequencies ranging from 200 kHz to 25 MHz.

Reliable says that the equipment

HOW TO SOLVE AIRCRAFT AND COMPONENTS DESIGN PROBLEMS WITH SILICONE IDEAS



Problem: Find a high-temperature silicone rubber that can withstand 400°F.

Solution: Use grade with GE silicone rubber insulation.

Respond to an 1800°F flame for longer, GE silicone rubber insulation still maintains defining an air of silicon dioxide, an excellent heat conductor. No insulation is available for temperatures above the curing, as the laboratory experiment on the left shows. Silicone rubber has superior dielectric strength at high temperatures and lasts 40 years. It stands up well to oil and fuel splashes, has low water absorption. It is highly flexible down to -15°F.

Check into the specifications for silicone rubber insulation and you will find a number more than standard sizes, and no limit to either length or cross-section width.

Technical literature and names of qualified users and their manufacturers are available on request.

Problem: Generic rubber parts failing because of temperature extremes and minor high tear and tensile strength cannot be accepted.

Solution: Replace with GE-S55 silicone rubber with tear and tensile strength comparable to generic rubber.

GE-S55 is a new silicone rubber with tear and tensile strength double that of ordinary silicone rubber (one component typical values of 100%). Whereas maximum temperature resistance and modulus extension (-20°F to 200°F) is required, minimum tear and tensile strength, specify GE-S525. This is the only material suitable for rubber laboratories that meets AMS 3343 requirements for tear and tensile strength, elongation, heat resistance, compression set and low temperature flexibility. GE-S55 is also recommended in pneumatic and electrical wiring.

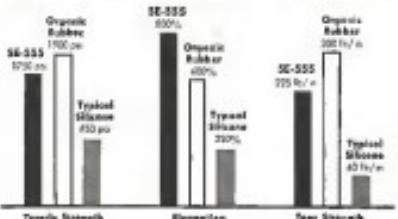
You can get high strength silicone rubber parts immediately because GE-S525 is available from stock for shipment to your destination. For more information, mail a list of qualified laboratories, and the coupon below.

Problem: Find a hydraulic fluid that becomes thin at -30°F to 200°F range needed for Arctic service.

Solution: Use Versoblock F-50. General Electric's new silicone fluid, with the best performance in this range of any hydraulic fluid ever available.

Over the -30°F to 200°F range, Versoblock F-50 achieves optimum performance at all these areas: thermal stability, hydrolytic, viscosity, temperature coefficient, oxidative stability, oxidation-threshold temperature and hydrolytic stability. The other successfully hydraulic fluid matches the threshold of 60°F to 100°F at -30°F to 200°F and for most temperatures up to 140°F. In general, it is unaffected at temperatures as high as 200°F and comparable to other hydraulic fluids in the oxidative range. Versoblock F-50 also maintains a more steady constant viscosity than other hydraulic fluids over the -30°F to 200°F range.

To make information about Versoblock F-50 and other GE hydraulic fluids, send the coupon below.



Write for more information.

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Section DT217, silicone products Dept.

General Electric Company, Waterford, N.Y.

Please send me a copy of your literature, plus names of metallurgists, etc. aircraft users, but not electric. I am interested in applications. I am interested in mechanical applications.

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relays

made by Sprague Products Co., of Boston, Mass., helps substantially in quieting controls of naval helo powerplants, transmissions, and results in considerable savings in the aircraft cost by reducing electrical circuit load. Subsequent noise-cancelling machinery is begun.

Decision Handed Down In Electrofilm Suit

Lawsuit filed by Electrofile Corp. in Superior Court of California charging Them-Globe Corp. with infringing the rights in a smoke detector and AW Pat. 2,395,642 Nov. 5, 1950, p. 341 has been settled. In a decision handed down recently Judge Louis Tadlock, chief federal judge of the 9th Circuit, held that Electrofile does have patent on smoke detector in all classes.

Amphibious Helicopter Finishes Flight Tests

Flight tests of the record Vertol HUOF-2 helicopter which was recently amphibious and Bell Corp. (AW Pat. 2,411,321) has been completed at the Flushing Bay, N.Y., test site. Machine is now working delivery to Patuxent

Naval Air Station for further test work.

During the flight checks, the helicopter was landed in water at take off up to 8 ft. and double the sink rate required by the Navy's rules. Powered speed was 120 mph and 5.4 ft. per sec.

Although amphibious, machine added a total of 310 lb. to the helicopter's maximum gross weight of 6,187 lb., 69 lb. of emergency flotation gear previously carried was removed. Result is a net weight increase of 280 lb.

Company Will Make Explosive Devices

Design, development, manufacturing and test services of packaged explosive power devices and related explosive components will be provided by a new engineering and production company, Inter-Tech, Holliston, Calif.

Product will range from gunpowder and liquid rocket engines, precision ordnance explosives, fuzes, time fuses, proximity detonators, and thermal or type gases to metal seals.

Mechanical and electronic parts and assemblies to integrate these components will also be designed and manufactured. Ernest J. Stroker, formerly in charge of facilities planning for Convair's Guidance Missile Division, is president of Inter-Tech.



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Never before in history has mobility meant so much in military planning and tactics. He who holds all the success, particularly for the U.S. Army, lies in the air—and VFD—far the only real revolutionary program.

—Hector H. de Onis

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The Mercury ARGO-L collapsible Motorcycle



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Helicopter Simulator Is Research Tool

By Craig Lewis

Pl. Wieliczka-Ulager helicopter engine has been developed by Bell Aircraft Corp. as part of a long range program to design an ultralight helicopter instrument flight system.

Students employ a contact analog to simulate contact helicopter flight and will be mounted on a dynamic platform to simulate actual flight motion.

This simulator concept is now in operation at the Bell plant here.

Bell developed the simulator as part of the Army-Navy Instrumentation program at share with Douglas Aircraft Co. under the supervision of Office of Naval Research (AW Dec. 21, p. 51). Bell is prime contractor as a program aimed at development of an optimum helicopter instrument system, and Douglas runs a similar program for fixed-wing aircraft.

Psychological Team

Bell's contact analog could eventually take the basis for a refined instrument flight system, but right now its primary use is in the simulator system. Students will be used for psychological tests of various displays to determine the optimum display system for people, efficient helicopter operation.

Contact simulator system is built around a closed sheet-metal cabin equipped with a seat, flight controls and a contact analog display. The display presents two pictures to the pilot—one

represents a static straight ahead and the other a view descended at a 45 degree angle.

These pictures are presented on row 17 in cathode ray tubes, and the system will be able to use five tubes when they become available.

The display can indicate pitch, roll, yaw, altitude changes and forward and lateral velocity. The display depicts one flight in terms of a field of squares. The student can choose this grid pattern corresponding to a distant horizon, while the downward view is filled with a grid pattern.

Grid Simulates Motion

In flight simulations, the grid pattern moves just as terrain would appear to move in advance to the pilot's actual contact flight. The square elements or diamonds are used to simulate altitude changes, the horizon moves to indicate roll or pitch. And other controls, such as the pitch has fast horizontal motion over the simulated terrain and what direction.

The display system is run by an analog computer through a display generator.

A test program is set up in the computer, and signals are sent to the generator. Bell is using an electromagnetic generator now, but an electro-mechanical generator being developed by Delco-Lederle will replace it around the first of the year, and the new generator will give the system smoother, more precise displays.

Two television cameras pick up the grid patterns from the generator and display it on the two cathode ray tubes in the simulator cockpit. In the future, Bell may shift to a color dot pattern to replace the grid rows to use.

The pilot chooses the loop in the system when he moves the controller controls in response to the display. These movements go to encoders and also to the computer, which then develops signals for adjustment of the displays.

Each flight cycle, data from platforms developed by Franklin Institute will be added to the system. It will be driven by hydraulic servos and will return to the simulation process.

When the Franklin processor is installed, Bell will be able to fly the contact analog system as in HTL-7 helicopter. An HTL-7 cockpit will then be installed on the simulator platform to complete the system's functions under flight condition and study situations.

You will give a precise test of the fidelity of simulation advanced.

Testing Program

Bell will use both the present cockpit and the HTL-7 cockpit for the test program. The HTL-7 cockpit is more sophisticated since it provides the standard set of helicopter instruments and controls, and the test subject can simulate such things as engine starts.

The testing program is starting out with very simple flight equations, although the computer and system can



Foirey Ultra Light Helicopter Goes to Sea

Tip-jet helicopter developed by Foirey Aviation Co., Ltd., of England, is based on platform of stem of R.M.S. *Glenrothes* in the English Channel during evaluation tests of the aircraft's ability to operate at sea. Helicopter is powered by a Blackburn Turboshaft Palatine turbo-generator which supplies compressed air to pressurize seats at 10,000 ft. (AW April 8, p. 94).





ROBIN MATT

The M-10 Artificial-Size ejection seat in the nose of this 100-ton Bell 205 helicopter.

N. S. MATT

Mr. N. S. Matt, Vice President of Sales and Marketing, is shown with the M-10 artificial-size ejection seat. The seat is designed to fit into the nose of the Bell 205 helicopter. It is the first of its kind ever made.



Martin-Baker
Aircraft Company Limited - England & Canada

handle such complicated equations as those for the H-90 turboshaft helicopter. These will use fixed-wing equations and involve only level flight. The Bell testors want to concentrate on display problems and eliminate helicopter related problems for the time being.

Subject Source

Subjects for the testing program will be drawn from Bell's future publications, although students as local as London will be welcome.

All subjects will be male and should be in shape above average as possible. Testers will be subjects who have never flown in a helicopter, and in many instances will be persons who have never ridden in one.

Bell's research work is part of its long range space for an ideal helicopter design under the Army's New Program. Bell's program, called advanced helicopter design, was started two years ago, about a year and a half after Douglas' work at Radlett began.

Bell's program is based on the fact that the aircraft and especially the Army, need a helicopter that can fly at low altitudes in bad weather without ground aids. And the instrument system should be so simple that the average helicopter pilot can fly it without extensive special training.

Since most helicopter instrumentation is actually fixed-wing aircraft equipment and not very efficient for helicopter operations, Bell is starting from scratch to design and develop instrumentation specifically for helicopters.

Human Engineering Program

Such a program starts with the pilot who must use the instruments, and Bell has launched a substantial human engineering program to determine what instruments a pilot really needs to operate a helicopter. Courtney and Associates has completed a study for Bell on pilot information requirements for each mode of flight.

Bell will take this information and determine which flight data are most important, what instruments are necessary for certain flight modes. The results will be valuable in the planning of test pilot training to various phases of operation. When Bell settles on what data should be presented, the next problem is how to present it, and the question just as how to best simulate types of data displays. While this evaluation work is going on, Bell can anticipate certain hardware needs.

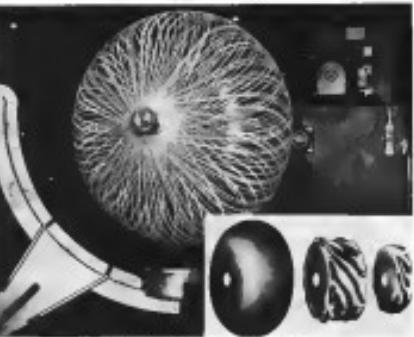
Development of an altitude computer has been ordered, and feasibility studies have been undertaken for such basic instruments as altimeters, airspeed indicators and obstacle detectors. Work is also being done on logic circuitry.

OFF THE LINE

Wyle Laboratories, El Segundo, Calif., is constructing a high-flow liquid and gaseous oxygen facility for testing aerospace components and systems, as well as for drawing and preloading composite materials for aerospace use. Technical assistance for the project will be provided by Ladd Co., a division of Union Carbide Corp.

Parker-Elmer Corp. reported annual sales of \$12,715,585 for the fiscal year ending July 31, 1967, ahead of last year. Net income was \$508,845, equivalent to \$1.15 a share, compared to \$384 a share last year. Company's backlog of orders at the end of the fiscal year was \$8,480,000 and working capital reached \$2,766,778.

Parker-Elmer's expenditures for research and development for the next year are estimated at \$3,741, almost double \$1,811,307 spent the previous year. Company is expanding its headquarters at Norwalk, Conn., and is establishing subsidiaries in Canada and Eng-land.



Folding Tire Developed

New type of aircraft landing gear, based on use of a folding tire, is being developed under a research program by Fairchild Aircraft Division. Progress has entered the research or prototype phase. New tire and gear system is expected to solve many existing problems of short takeoff and landing (STOL) aircraft on unpaved surfaces. Inlet shows (left) is right side folded tire, ported inflation, and folded tire on-eights the size of fully inflated tire. Features of the tire include confinement, high tensile rubber cord wound around the base body (main package) to provide confinement at point when lugnut status is expected, and an automatic reset system for deflating and folding the tire so that it can be stored in case of a strand of the tire. Added advantage of the valve is that it allows the tire to be a high pressure and low pressure on paved surfaces and a low pressure for when place may be rough unpaved fields. Folding feature does away with huge tire problems of conventional low pressure tires.

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INERTIAL GUIDANCE



KEARFOTT has been engaged in the development, production and flight testing of Inertial Systems and their components for over 7 years. Their leadership in the field of lightweight, high precision Inertial Guidance Systems for aircraft and missiles has been proved by performance. The equipment shown here is a typical KEARFOTT inertial platform.

CENTRAL GYRO REFERENCE SYSTEMS



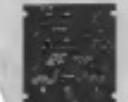
Based on the 3 gyro, 3 gyros, 3 gyros platform weighting 25 pounds each, KGS-1000 reference (2 gyro per dimension) offers oil-damped oscillations as guaranteed. This system also serves as an all attitude compass system with 1° per hour resolution drift rate. Its performance is substantiated by the hundreds of systems in operation today.

LIGHTWEIGHT ALL ATTITUDE COMPASS AND VERTICAL REFERENCE SYSTEMS



Based on a 29.5 pound 3 gyro, 4 gyros platform, KGS-1000 All Attitude Compass System provides continuous bearing digits throughout in 100% redundancy. It is designed to meet the requirements of the U.S.A.F. 14 Systems, primary vertical reference for the control, autopilot and control stick operation is available. Powered by 2 portable servos in the field. Total system weight—37 pounds.

GREAT CIRCLE NAVIGATION COMPUTERS



Excellent great circle aerial reckoning computer systems, continuously compute and display present position, distance and direction to a selected destination, determine latitude and longitude of the destination point. Ground track is also indicated. Range: 2000 miles, speed: 3000 knots. Previous flight tests have confirmed the following accuracies: Present position: within 1/16 of a statute mile; Estimated miles per 1/16, Correct 1/16.

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Only the indispensable elements of KEARFOTT Components have been described briefly. KEARFOTT Systems, possibly KEARFOTT Components include Gyroscopes, Linear Accelerometers and陀螺仪 sensors etc. Their popularity has been proved by planned reelection services from many The control, selection, reader and navigation systems. Write today for descriptive technical data.



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PUSHING UNIT CRANE weighing 1,800 lbs. (above) is loaded onto Doman LZ-5 at an oil field supply point for flight to a well head. LZ-5 (right) at a drilling rig located in deep marsh country. An engine is loaded on the helicopter (below) at the oil field. LZ-5 made more than 100 successful flights in Louisiana, Texas, Oklahoma.



Doman LZ-5 Gets Oil Field Check-Out



AT OIL DRILLING RIG in Coaling, Okla., Doman LZ-5 methods some needed parts. In course of about a month's demonstration in Southwest oil producing areas, the helicopter carried 250 passengers in addition to cargo. LZ-5 fuel consumption averaged 18.3 gph.

Piper Revises Product Lineup for 1958



CUSTOMIZED tail gear fairing of new Comanche 180, costing \$4,500, is only \$150.

By Erwin J. Bellows

WILMINGTON, Pa.—In face of an increasingly rising buyer's market brought about by the business aircraft industry's high production rate of newest vans and to meet stiffened competition, Piper Aircraft Corp. has made major revisions in its product lineup for 1958.

Company distribution and checkin stations have been moved since last year to show their importance in the Piper line for next year.

* Four production models of the new PA-24 four-place low-wing Comanche, which are scheduled to go to customers sometime in February. Distributors will begin receiving Comanche demonstrators in December 1957.

* Apache light twin powered by 360 hp Lycoming O-320-BIA high compression engine, providing a cruise speed of 114 mph at 7,750 ft; power to weight ratio of 1.06 lb./hp. Take-off and climb are improved about 10% and range is increased 7%.

New Airplanes

Piper engineers listed the content slightly as far as the future is shown the company's sales force a new airplane they have under development for 1958—the light twin Apache with improved Apache fitted with 250-hp Lycoming O-360 engines providing a cruise speed

180 mph current Comanche, will be ready for production in mid 1958.

Standard version of the Comanche 180 will cost \$14,500 with basic instruments and avionics radio. Two other models will be available. One will be Super Comanche, which will have a larger Supercharger with more controls, low frequency receiver with separate power supply, handset interphone and two antennas, additional landing, directional gyro, electric turn and bank indicators, rate of climb indicator, clock, outside air temperature gauge, vacuum pump and drive. Super Comanche will have the equipment plus a North Star compass N-7 with two crystals in place of the Supercharger and EL receiver and Luis ADF 12E. Although no prices are officially quoted by Piper for this model, indications are that the Super Comanche 180 will cost up to \$10,000 more.

Initial Run

Initial production of the Comanche will be kept at approximately 4,000 units during the first year, probably because full racing will take about three to complete. High volume output of that plant would require a racing plant in price because of added labor costs that would be required—perhaps more than \$4,000. Aviation Tax will be paid.

Also currently in flight test is the joint powerful version of the 180-hp Comanche fitted with a 250-hp Lycoming. This airplane, which will be approximately 25 mph faster than the

of more than 200 mph. Gross weight will be approximately 4,500 lb., compared with Apache's maximum gross of 3,600 lb. Companier has been fighting to get a commercial Apache with 250-hp engine for six months.

Also currently in flight test is the joint powerful version of the 180-hp Comanche fitted with a 250-hp Lycoming. This airplane, which will be approximately 25 mph faster than the



LITTLE CHANGE, except in paint scheme, is evident in 1958 PA-18A utility model.

lowered or 18 mph. Carrying the usual one fuel load of 50 gal., range is 400 miles with 60 gal.; at five power and altitude, range is increased to 500 mi. A detailed Aeromexico pilot technical report of the Comanche 180 will be issued in a forthcoming issue.

Higher compression (10.5:1) engines for the Apache and Tri-Pacer provide the additional 10 hp at a weight increase of only six pounds. This makes possible more efficient fuel consumption, since they burn .45 lb./hp hr. in against .49 lb./hp hr. for the former 150-hp engine.

October Rating Important

But owners are cautioned by Licensing that use of 91-96 octane aviation gasoline in the 400-hp O-360-BIA and -BIA engines is mandatory. Failure to maintain this requirement will lead to loss of all warranty on the engine. Licensing points out that it will be sensible for operators of these engines to stay with the gasoline while awaiting new fueling procedures. An estimate of the new octane needed takes 10.97 octane in the Apache. If there is no 91-96 octane available, Licensing notes that the owner should go to the next higher rating such as 101/100 at 11.5/11.5.

Use of 10.97 on the high compression engine will probably lead to detonation and preignition causing burst pattern, broken valves and damaged rings and resulting in trouble and expense before continued use of lighter grades than recommended prevents fatal locking.

Another new addition to offer the 1958 Licensing is both the Apache and Tri-Pacer. Both are now available, but expect that in largest sales in 1958 will be for the lighter powered models.

Individual Seats

Seating changes on the 1958 Apache include use of two individual seats with or in place of the standard full width seat or center console—seats are adjustable fore and aft and backs can be tilted to one of three positions, the far forward position being the most comfortable on the surfaces. If desired, a 400-unit run can be fitted in the floor tracks. With the increased seats, the Apache can carry five passengers with full seat backs (72 gal.) and full instrument (32 gal.) for a weight of more than 1,300 lbs. Piper points out:

Another坐姿 innovation in the new light twin is a substantial head rest for each seat as optional equipment.

Aerostrutronic, a wing strut, will be added at the leading edge to assist in roll over over the wing and not let it snap open, cutting down much of the Apache's load on landing and stiff speeds. A larger 27,700-lb. Smith and Wesson carbon fiber has been



HIGH COMPRESSION 160-hp Lycoming provides 2100 with gains in performance (see data below). Improved carburetor heat system, wing flaps and strong new frame.

1958 Piper Apache

SPECIFICATIONS

True level flying	O-360-B engines—160 hp at 10,000 rpm	
Gross weight (lb.)	3,600 ^a	3,100
Empty weight (lb.)	2,320	2,200
Fuel load (lb.)	1,280	1,100
Post-overhaul fuel (lb.)	72	72
Auxiliary tank location	100	100
Length (ft.)	37	37
Width (in.)	80	80
Height (in.)	10	10
Wing loading (lb./sq. ft.)	17.3	16.8
Power loading (lb./hp)	16.4	11.7
Baggage capacity (lb. maximum)	300	200
Passenger accommodation for 6	20	20
Gear space (in. H) floor and rearward	60	60

^a These new flights will not need the large payload developed into the Apache, which at 3,600 lbs. gross are furnished as well as an 8,000 lbs.

^b Landing distance—standard Apache (3,600 lb. gross).

1958 Apache Performance Data

Sea-level length	99	100
Ground roll at altitude 7,000 ft. at 95% power—(sq.)	973	170
Rolling radius (sq. ft. ground area)—(sq.)	44	44
Take-off roll (ft.)	100	100
Landing roll (sq. ft. ground area)—(sq.)	600	720
Rate of climb (sq. ft. ground area)—(sq.)	100	100
Rate of descent (sq. ft. ground area)—(sq.)	100	100
Single-engine rate of climb speed (sq. ft.)	92	92
Single-engine rate of climb (sq. ft.)	200	200
Service ceiling (ft.)	35,000	35,000
Absolute ceiling (ft.)	22,000	20,000
Emergency absolute ceiling (ft.)	21,000	19,000
Service ceiling (ft.)	10,000	10,000
Altitude ceiling (ft.)	9,000	8,000
Emergency altitude ceiling (ft.)	8,000	7,000
Ground range (sq. ft.)	400	400
All 95% power at sea level (sq.)	400	400
All economy cruise (sq.)	400	400
Ground range (sq. ft.)	300	300
All 95% power at sea level (sq.)	300	300
All economy cruise (sq.)	300	300
Ground range (sq. ft.)	200	200
All 95% power at sea level (sq.)	200	200
All economy cruise (sq.)	200	200



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Model W1803—Tramutated Servo Amplifier; one 3 1/2" dia. x 5 1/2" long, weight 3 oz.

Model W1804—Tramutated Servo Amplifier; one 2" dia. x 2 1/2" long.

In the housing of the W1801 Servo Repeater System (illustrated) are all the electronic and electro-mechanical components to develop shaft position output with torque exceeding 20 oz-in. Static accuracy is within 0.1° of input from synchro or transducer. Velocity rotation is 60 sec.⁻¹. Response only 1/57, 400 cps plus. Other configurations are available to suit your requirements. Use include control of positioning devices, valves or computer elements

May also be used as aircraft indicators. Many military specifications.

Model W1803 Amplifier as used in the W1801 Servo Repeater is designed for maximum volume output—15,000°/sec.

Model W1804 Amplifier is intended electrically for power and for maximum volume—1" x 1" x 1".

Reliable, rugged synthesis, potentiometer, or other transducer data. Both have one 8 or one 16 ohm.

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installed replacing the former 20,000-lb. unit, new heating coil has been reduced to 250 watts from 100 watts and the coil has been separated. In the latter change, Piper engineers say this cut a fat 200-lb. rise in the aircraft's air load with practically no drop in manifold pressure.

Pipes for the 1958 Apache start at \$55,900 for the Standard model with 160-hp. engine. Custom version will be \$18,945 and Super Cessna will be \$40,751. For comparison, the 1956 Apache with 150-hp. Lycoming will cost \$34,995 for the Standard model, \$17,945 for the Custom and \$19,195 for the Super Cessna.

Aside from interior remodeling and the 180-hp. engine, the new Tri-Pacer is basically similar to previous models. Prices for the 1958 models Standard, \$14,995; Custom, \$10,170 and Super Cessna, \$10,475. With the 180-hp. Lycoming, respective prices are \$5,355, \$10,075 and \$10,375.

More Details

Knowing their growing popularity, more distributor and dealer personnel and sales attendants for 1958 will be meeting this year at various points, including a clinic during the company's biannual trip to Lockheed's nearby Worldwideport.

There were approximately 100 distributors whose sales on the final day during September 30th were in the \$1 million bracket, one whose tally exceeded \$2 million by a wide margin, one who almost reached \$1 million and another who came close to \$1 million.

For 1958, Piper sales manager J. W. (Bud) Miller set a goal for the 1958 fiscal year of \$19,250,000 in commercial sales at list price. This compares to \$155.7 million for the calendar year 1957. And he told them that he is going to re-evaluate a \$60 reduction in list prices in 1958.

Indications are that Piper's executive sales volume in fiscal 1958 will come in much from increased prices reflecting a jump in number of units. Last year off the sales list was after the firm was aircraft industry's record increase in 1956 will probably continue into 1958, and there show another major sales hike. Miller told Aviation Week.

One of the major obstacles facing the industry this year is the lack of orders from overseas buyers, according to the source quoted. Piper didn't seem to feel Up to the sales picture has been much one of "laminating," with only about 15% of sales going to foreign buyers.

Finsancing Aid

While use of financing would brighten the picture, Miller noted he pointed out that the top Piper dealers



APACHE panel is especially designed to take a large variety of modern flight equipment.



NEW TRI-PACER, with 180-hp. high-compression Lycoming has 75-cubic-inch mag.

1958 Piper Tri-Pacer

SPECIFICATIONS

Engine	Piping 3300-8 180-hp @ 2,900 rpm	PERFORMANCE	Flight capacity (lb.)	140
Gross weight (lb.)	2,100	Cruising speed (T, 100% fuel rate)	130	
Take-off weight (lb.)	2,100	Climb (10°, 100% fuel rate)	130	
Model limit (lb.)	400	Stall speed (Phase I, level flight)	40	
Wing span (ft.)	39.2	Rate of climb (S)	400	
Wing area (sq. ft.)	347.8	Service ceiling (ft.)	16,000	
Wing area (sq. in.)	3,356	Absolute ceiling (ft.)	16,000	
Length (ft.)	30.6	Fuel consumption (at 75% power)	9.8	
Height (ft.)	8.10	Glide ratio	3.0	
Propeller diameter (in.)	4.10	Glide range (with 36 gal. fuel)	140	
Power loading (lb./hp)	12.8	(at 75% power) 6,000 ft.	130	
Wing loading (lb./sq. ft.)	10.6	Glide range (with 44 gal. fuel)	180	
Empty weight (lb.)	1190	(at 75% power) 7,000 ft.	180	



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Bring your tough ones to Zenith

Like a missile with a man in it, the Lockheed F-104A soars the sky at speeds of over 1,200 mph—and Zenith riders with it, right on the nose!

To build the surface on this remarkable aircraft demanded unique construction techniques and the constraints of a somewhat fragile material. Like Resin-Bonded glass fiber radomes, the radome is an integral part of the aerodynamic design. To effect this radome in the F-104, Zenith had to work with the velocity of a 25-inch shell. It must withstand the shock of the sound barrier. It must reduce the weakening heat of atmospheric friction. And it must maintain its dimensional accuracy uninterrupted.

To meet these extreme requirements, Zenith worked hard and long with Lockheed engineers. The result was a new

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FORM OF THE FUTURE: RESIN-BONDED GLASS FIBER



Sabre Clips Apache

Piper Apache light twin business plane made a soft landing at Bishop Airport, Calif., after the top of its tail was clipped off by a tree-plane collision at 9:40 a.m. On Dec. 19, 1967, Apache Aerobat crashed in vicinity of Evergreen at about 2,000 ft. It makes business VFR operations easier. Apache Aerobat's first sale was in 1966 to F. R. Thompson. According to Thompson, subsequent investigation revealed that none of the pilots involved ever met each other. Both An-Foxes had the FRLIs on its seats, but not the Apache.

Two last year probably exceeded 80% of their sales. Those not exceeding their quota probably sold financing on only 10% to 15% of their business. Last August we had available showed that in 1968 about 50% of the aircraft sold were mortgaged via financing.

Importance of dealers selling used Piper airplanes has increased rapidly in recent years. This is due mainly to the popularity of the Apache. The Apache's resale value also is emphasized. In Milco, Inc. He pointed out that over 15 used Apaches in 25 states and Tri-Penn in "outlets" (chain) on noticeably depreciated prices of earlier models.

Suggested was a method of rebidding used Piper aircraft held in dealers and a system of evaluating the lot among the other competitors so that the aircraft could be placed where they might be needed. Then, increasing the chance of increasing the price of planes going out on the open market.

Export sales are showing steady increases, as Folland reported. Piper arrived 321% of its total exports compared to 14.2% in the previous year. In fiscal 1957 40% of all PA-18s and PA-18As were abroad in the about 33% of the total Apache output and about 15% of Tri-Penn production.

Delivery to New Zealand, for example, was made from two Piper in-

planes in 1953 to 1959 to 52 in 1957. Easing of import restrictions in that country and Australia made those imported planes markedly increasing in distribution in those areas. The Aviation Law Directorate said Aviation Imports that year were the new record. Pipers of all varieties have been the best export leaders to bring in 48 since that year and will bring in a Consolite as soon as he can get one.



British Test 'Luxury' Light Plane

Designed specifically for executive operation, new Avon Atlantic business jet is designed to compete with Piper Tri-Penn and Cessna 172-352 series business planes. Avon reports he hasn't yet flown the unproduced type version, only a reduced prototype. Powered with a Continental 1105-80 engine rated at 205 hp, weight and 105 hp, overall, the Atlantic is designed to cruise at approximately 125 mph and have a range of 800 mi. Planes in a standard configuration of 742 lb. gross weight and 450 lb. payload. Maximum speed at 40,000 ft. range is estimated at 813 lb. at 224 mph. Takeoff distance is estimated at 133-215 ft. in still air depending on load; rate of climb would vary from 800-1,100 ft./min. Although the airplane has yet reached the production line, Avon estimates that fully equipped it will cost approximately \$16,000. Among equipment planes in American-built NASA radio (upper right on prev.).



Addison Airport Makes Lease Arrangement

Long-term leasing arrangement of 57,000,000 sq. ft. of land at 160 ft. x 160 ft. lots at Addison has been arranged between Addison Airport, North Dallas, Tex., and United States Leasing Corp's Dallas office.

Recently, U.S. Leasing purchased the

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Boeing has openings, now, for scientists, and for engineers in many categories.

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two new hangars and re-lease the property to Addison Airport, Inc., which in turn is leasing them to investors, plus own an long-term arrangement. The company has also invested for business space operations, comprising a total investment of \$2,291,000 in facilities.

According to Leo Van Arsdal, Southwestern representative for U.S. Leasing, the company currently has an unused credit of \$16 million for making similar arrangements with airport operators.

Private Contractor Wins Army Contract

Curtiss-Wright Aerospace Flight Service has again been successful bidder to operate the U.S. Army's instrument flight school, providing students eight weeks of training, including 78 hours flight time, 48 hours instrument training and 50 hours of classroom instruction.

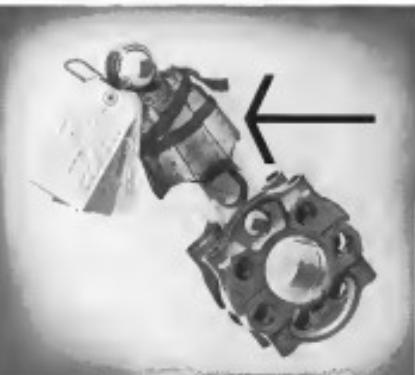
Dubbed "Flight Field," Aerospace Flight Center is the industry, and by extension research laboratories, covering a tremendous range of engineering fields and the sciences. You'd be able to draw on modern electronics data processing equipment, and such test installations as one able to simulate flight environments at 300,000-foot altitudes.

If you find that facilities of this kind could help you get ahead faster, go in touch with Boeing.

Boeing has openings, now, for scientists, and for engineers in many categories.

According to the developer of the system, it is so efficient that it removes twice as much waste. Boeing is reported to weigh 140 lb. less.

New host-type equipment currently being developed by R.F. Goodrich will probably weigh about 90 lb. Although it may prove principles, the system will actually be new. Company engineers estimate that they can take about 20% off weight of current hosts by using a thinner material. In addition, current pumps, changing valves and other components will be replaced in place of assemblies where some 50% of required solenoids can be deleted, saving at least 10 lb.



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CARRYING load of structural steel for power line towers, a Sikorsky S-58 has saved its maximum cargo area.

S-58 Expedites Power Line Installation

By Richard Swersey



AVERAGE time of eight minutes from loading depot to tower site was 3.5 mi.

S-58 DROPS load of steel (below) at tower site. Two pilots sharing tasks improved efficiency.



Lighting Time Cut

Another aspect of eight men and cost are proceedings involved when a company has to stand by for condemnation proceedings to acquire the right to install lines. Use of the helicopter first enables a company to file condemnation cases where difficulties would normally result in establishment of class rating loss of time in litigation legal costs. Beyond, it enables a company to quickly install a more complete line without part of it held up in his proceedings.

Rover Aids and the preference of the telephone for others to plan the



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New positions in:

MISSILE SYSTEMS AERODYNAMICS

Weapon systems management activities at Lockheed's Palo Alto, Sunnyvale and Van Nuys organizations call for major achievement in aerodynamic areas such as: Theoretical and experimental investigations of the aerodynamic characteristics of missiles at Mach numbers through the hypersonic range; optimization of controlled missile performance; specification and interpretation of experimental aerodynamic investigations required to verify and improve missile and weapon system design; analysis and interpretation of aerodynamic flight test data. Initiatives are strong. Please address the Research and Development Staff, Palo Alto 17, California.

Here members of the Aerodynamics Dept discuss findings of jet-travel studies. Left to right: W. E. French, aerodynamics analysis; M. Taylor, Aerodynamics Department Head; R. L. Nelson, project aerodynamics; R. W. Marsh, aerodynamics; J. F. Osborne (back to camera), aerodynamics.

Lockheed MISSILE SYSTEMS

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Executive Convair Gets Light Stairway

Retractable stairs, some 20 ft. lighter than standard Convair-Leveray modifications, were fitted to the executive CV-240 which was built of cut-down parts by Pacific Aircraft Corp., San Bruno, California. Andrew Anderson, Jr., is a man especially interested in development of aircraft with retractable stairs. Pacific Aircraft installed its version of the plane's rear door, made provisions for opening it from the cabin or from the ground. Major problems involved space limitations, proper alignment of support arms and surfaces exclusive to steps and door, the door's load-carrying potential requirements for various stages of retraction cycle. Modified CV-240 belongs to Messier Corporation of America, Detroit, Michigan.

following sequence for construction of the next transmission line:

- Edison will be able to go into areas where rights of way will not loss will not need access roads, and bars can be set along better routes through rough terrain.

- Surveyors for rights of way will be accompanied with full fall equipment.

- Steel crew car will be driven to clear area where maximum loadings weighing less than 3,500 lb. can be transported in, until a clear 30x30 ft. tower site.

- Portable tower will be raised in to dull facing holes. Reinforcing and fastenings, slightly liberalized upon project scope, will be supplied by helicopter to site.

- Ready-made concrete, weighing approximately one per cubic yard, will be added to location. Back tower is quarter four footings, with 4-in. x 30-in. top.

- Tower steel will be known in, bundled for 3,500 lb. per load.

- Tower will be erected with floating gantry pole, which weight less than 3,500 lb., will be raised by helicopter from site to site.

- Line strapping will be accomplished by helicopter and ground crews.

In transmission lines, conductor cable is not completely laid at each tower, rather it is attached at various even strong points called dead end towers which are located with varying numbers of supporting towers in between them.

ing to terrain. When a section is to be string, crews fly in a liaison machine to the dead end tower at each end of section to be spliced.

Stringing Operation

Using steel, a Bell helicopter will place 4-in. round tape from one dead end tower to another with splicing equipment for tape connection, then placed by ground crews while "people" lower. Ground crews will then transport machine to pull line if accessible nears the spur in place of rope. Aircraft cable will pull line, just rope splice place, which will in turn be used to hold the very heavy conductor into position which it is hauled to dead end tower and attached as necessary to intermediate supporting towers.

Tower installation costs will then be passed to east service that is to be strung.

In feasibility program, several theories worked against the helicopter. The steel was already bundled for trucking in packages varying from 1,700 to 3,500 lb. A 50% increase in efficiency could have been gained if the steel was bundled to 8,500 pounds measures 3,500 lb per flight capacity. Also, to take advantage of road network along already existing line, Edison is constructing a new line due to the opening high voltage line, connecting the base to a helicopter landing field of steel. Another hazard was flying wire over loose rock below insulation bags where

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Unobstructed and rough air moments were minimized.

Despite non-negotiations, helicopter rental by some favorable standards fit the operation.

In all programs, 3,185,175 lbs were included in 61 hrs. 33 min flight time, including return time from base station to Vicksburg. At Vicksburg, the three trips made in low-level deports. Round-trip was planned so that the average loss of sight distance from top trip was 1.9 mi from depot to tower site.

Base operating day rate was \$18,072 incurred in 8 hr. If more flying time fluctuations occurred in daily weight total due to variation in loads, widely cited was primary range, "optimum load utilization, location of bolt holes and various inserted bolt retention items for construction. Budgets, stages and other equipment used in the job had to be retained from tower site to landing deports.

Finished Quickly

Both Aids originally planned the operation to take around of four weeks. However, job was finished in 15 flying days between Sept. 30 and Oct. 18. The last of 15 calculate days in which 51 hr. 10 min were flown to land 936,709 lb. direct operating cost was \$11,150 excluding depreciation and insurance.

Other aspects brought out in operation included:

- More efficient use of personnel. Both Aids lifted two loads with one crew in lifting and pilot. By the same standard two workers to the tower site for installing equipment gave the aid helicopters and crews less time to be cargo capture while the site was being prepared. When jobs were completed, both lifted easier crews in need site.

- Planning around helicopter from the beginning minimized some charges in time incurred padding for inspection, such as pay of overtime work, normally prolonged to \$3,000 hrs., to be reduced to 1,200 hrs. mark.

In the landing operation, Both Aids found that better overall efficiency resulted from having two pilots aboard the S-55. While on the part of the job the two pilot system was adopted, but when operations were very close to existing or high voltage line, but during of pilot took increased efficiency in view where existing line was remote from a safety standpoint.

Additional Pilot Duties

At the landing deports, one pilot again used at least signature to cargo pilot, supervised steel load groupings to prevent inadvertent overloading kept time, got speeds.

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AVIATION WEEK

Classified Advertising Division

AVIATION WEEK, November 4, 1957



Pathfinders of the airy blue

ATRAN is an accuracy navigating device developed by Goodyear Aircraft engineers. It is so vital to our national security, the facts about it are still top-secret.

To master the mystic forces of the sky—that is the purpose and the plan at all Goodyear Aircraft engineers.

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